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PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY

HELD AT PHILADELPHIA

FOR

PROMOTING USEFUL KNOWLEDGE.

Vol. XXV.

JANUARY TO DECEMBER, 1888.

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AMERICAN PHILOSOPHICAL SOCIETY,

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VOL. XXV. JANUARY TO JUNE, 1888. No. 127.

Stated Meeting, January 6, 1888.

Present, 22 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows: Letters accepting membership from Prof. J. Szombathy, Wien; Mr. S. Castner, Jr., Philadelphia.

Letters acknowledging receipt of diploma from Prof. J. Szombathy, Wien; Hon. Victor Duruy, Marquis de Nadaillac, Paris; Prof. Edward North, Clinton, N. Y.; Prof. Schele de Vere, University of Virginia.

Letters of envoy from the Mining Department, Melbourne; Physikalisches Central-Observatorium, St. Petersburg; Musée Guimet, Paris; Royal Observatory, Greenwich, London.

Letters of acknowledgment of receipt of Proceedings from the Geological Survey of India, Calcutta (125); Zoölogical Gardens at the Hague (125); University Library, Lund (125); Prof. Richard Akerman, Stockholm (125); R. Statistical Society, London (124, 125).

A letter from the Pennsylvania Commission on Amended Orthography, Harrisburg, calling attention to the work of the Commission, and asking the Society to assist in the examination of the defects of our orthography by the appointment of a committee or some other action.

A letter from Harvard University Observatory asking that

the deficiencies be supplied in its series of the A. P. S. publications.*

A letter from the Free Public Library, San Francisco, asking for the Society's Catalog.*

A letter from Prof. Lewis M. Haupt, acknowledging the receipt of a communication from the President of the Society informing him of the award to him of the Magellanic Premium for his paper on "The Physical Phenomena of Harbor Entrances."

A letter from the Wisconsin Historical Society requesting Part IV of the Society's Catalog.*

Accessions to the library were received from the Société Impériale des Naturalestes, Moscow; New Russia Society of Naturalists, Odessa; Comité Geologique, Physikalische Central-Observatorium, K. Akademie der Wissenschaften, St. Petersburg; Gesellschaft für Erdkunde, Berlin; Gartenbauverein, Darmstadt; Astronomische Nachrichten, Keil; Verein für Erdkunde, Zoologischer Anzeiger, Leipzig; K. Statistika Central Byrån, Stockholm; Bataviaasch Genootschap van Kunsten en Wetenschappen, Batavia; Société Batave de Philosophie Expérimentale de Rotterdam; K. Bibliotheek, 'S Gravenhage; Académie R. de Belgique, Bruxelles; Biblioteca N. Centrale di Firenze; Société Historique &c. du Cher; Académie des Sciences, Arts et Belles-Lettres de Dijon; Sociétés d'Anthropologie, d'Ethnographie, des Antiquaires, Zoologique, d'L'Enseignement Supérieur; Académie Indo-Chinoise de France, Musée Guimet, Redaction Cosmos, Ministères de la Marine et de l'Instruction Publique, Académie des Sciences de Bordeaux; Mr. Henri Moissan, Paris; Société des Antiquaires de la Morinie, St. Omer; Société de Geographie, Lisboa; Royal Society, Royal Meteorological, Astronomical, Geographical Societies, Society of Antiquarians, Greenwich Observatory, Lords Commissioners of the Admiralty, "Nature," London; Essex Institute, Salem; Yale University, "American Journal of Science," New Haven; Brooklyn Entomological Society, Brooklyn Library; Prof. E. North, Clinton, N. Y.;

*Request granted so far as practicable.

Meteorological Observatory, New York; College of Pharmacy, "Medical and Surgical Reporter," Dr. I. Minis Hays, Messrs. Thomas Hockley, Henry Phillips, Jr., Mrs. Susan I. Lesley, Philadelphia; Second Geological Survey of Penna., Harrisburg; U. S. Naval Institute, Annapolis; Director of the U.S. Mint, U.S. Government Publications, Washington, D.C.; State Board of Health, Nashville; University of California, Berkeley; Sociédad Cientifica "Antonio Alzate," Mexico; Boletin de Estadistika del Puebla; Imperial Observatorio de Rio de Janeiro.

The Committee on *Volapük* presented a supplementary report, and the original report was, on motion, read as follows:

THE Committee appointed October 21, 1887, to examine into the scientific value of *Volapük* presented the following report:

Your committee proposes first to consider the desirability of a universal language; secondly, what should be its characteristics; and, thirdly, whether that invented by the Rev. Mr. Schleyer, called by him *Volapük*, meets the requirements.

I.

That in the vastly increased rapidity of interchange of thought in modern times, some general medium of intercommunication would be welcome, is unquestioned. Wherever there are close commercial relations between nations speaking different tongues, such media are sure to arise from the necessities of daily life. Thus the Lingua Franca in the Mediterranean and "pigeon English" in the Chinese ports are dialects which have sprung out of the urgency of business needs. These mixed languages are called "jargons," and have a very high interest to the scientific linguist as illustrating the principles of the evolution of human speech. The English language is a jargon of marked type, and illustrates what was stated by W. von Humboldt early in this century, that from such crossings and mingling of tongues, are developed the most sinewy and picturesque examples of human language. This consideration shows that in adopting or framing a universal language we need not hesitate to mould it from quite diverse linguistic sources.

The presence of a number of these jargons in different parts of the world testifies to the desirability for some one simple form of discourse which could be of general adoption. Another and higher testimony to the same effect is the need now frequently and loudly expressed for a uniform terminology in the sciences. For many years it has been urged

both in this country and in Europe, that the neologisms required by the sciences be derived according to a uniform plan from the Greek, and that those heretofore obtained from Greek or Latin be brought into one general form. There is no practical difficulty about this except that which arises from the Chauvinism of some nations which are blinded by egotism or narrow notions to the welfare of the whole. Such a tendency is observable in Germany, a country once noted for its cosmopolitan sympathies. Its medical teachers, for example, have of late frequently dismissed the terms of their science derived from the Latin and Greek, in order to substitute in their place long, awkward and inharmonious Teutonic compounds. No effort at a uniform international scientific terminology can be successful if the learned in each nation be governed by national prepossessions.

Another obstacle to a universal tongue, and which at the same time is a cogent argument for the adoption of one, is the sentimental love of local dialects and forms of speech by those who have imbibed them in infancy. To-day there are active societies organized for the preservation of the Welsh, the Armorican, the Basque, the Finnish and the Flemish. For many generations nearly all learned writings in Europe were in Latin. In the eighteenth century the Latin threatened to be superseded by the French. The Transactions of Academy of Sciences of Berlin were in French ; so were the articles by the Russian professors; and in the earlier decades of the present century French prevailed in the reports of the Royal Northern Society of Antiquaries, and in most scientific publications in Slavic and Northern Teutonic countries. This is the case no longer. Every little principality claims that it should print what it has to tell the world of science in its own dialect, and claims that the world of science should learn this dialect. Thus we have on the list of our scientific exchanges publications in Roumanian and Bohemian, in Icelandic and Basque, in Swedish and Hungarian, in Armenian and modern Greek, in Japanese and in Portuguese, without counting the more familiar tongues. Even a linguist by profession, such as Max Müller, has exclaimed against the very Babel, the confusion of tongues, which exists in modern scientific literature. He has sounded an earnest appeal to the learned writers of the world to express themselves in one of the half-dozen languages which every man of wide education is supposed to read, to wit, the English, French, German, Spanish, Italian or Latin.

But even with the advantage of a well-developed international scientific terminology, it is a good deal to ask of a student of science that he should spend the time to acquire a reading knowledge of these six tongues. In many cases it is wholly impossible for lack of time. But time could always be spared to learn one language, if that were enough, particularly if this one were exceptionally simple and easy in its grammar.

Again, the commercial and traveling world demands one tongue

only, in addition of course to that which its members learn in infancy, a tongue facile to acquire, and adaptable to their peculiar wants. The time is not far off when one system of weights, measures and coinage, one division of time, one code of international law, one mode of quarantine and sanitation, one costume, will prevail throughout the civilized world, and along with this unification of action must and will come a unification of speech. It is not only desirable, it is certain to arrive, and as beings of intelligent self-consciousness, looking before as well as after, it becomes us to employ our faculties to direct the course of events so that this one universal language be not left to blind chance, but be framed and adopted of deliberate choice and with the wisest consideration.

II.

Convinced, therefore, that the time is ripe for the promulgation of a general form of speech for the civilized members of the race, we will now inquire what should be the requirements of such a tongue to merit the recommendation of this Society.

We begin by the observation that the Aryan stock is now and has been for two thousand years the standard-bearer of the civilization of the world; hence, a universal language should be based upon the general linguistic principles of that stock. In the Aryan stock the six principal living tongues in the order of their importance and extent may be ranged as follows: English, French, German, Spanish, Italian, Russian. It should be the aim of the proposed general tongue to ally itself to these somewhat in the order noted; as thus being more readily acquired by the greater number of active workers in the world at the present time.

The elements of all languages arrange themselves to the linguist under three headings—phonetics, grammar and lexicography; in other words, the vocal, the formal and the material characteristics of the tongue; and under these three headings we will sketch the traits which should make the projected universal language.

I. *Phonetics.*—We believe all will assent to the following propositions:

The orthography of the universal language should be absolutely phonetic.

Every letter in it should always have the same sound.

This sound should be one common to all the leading Aryan languages, and hence present no difficulty to a person speaking any one of them.

Diphthongs, digraphs and double consonants should all be omitted as misleading.

The meaning should never depend on tone, accent, quantity of vowels, nor rising and falling inflections of the voice. All these are inadequate and unnecessary expedients of the linguistic faculty.

The vowels should be limited to the five pure vowels: *a*, *e*, *i*,

o, *u*, pronounced as in Italian, and all impure or modified vowel sounds, as the German *ä*, *ö*, *ü*, the French *u*, the English *u* (as in *use*), *o* (as in *not*) and the neutral vowel *u* (in *but*) should be discarded. All the Aryan tongues named possess the five pure vowels, but not all the impure and neutral vowels.

In the consonantal scheme, all gutturals, aspirates, lisps and nasals should be omitted. Thus, the German *ch*, soft or hard, the Spanish *z*, the English *h* and *th*, the French *n* ; and likewise all double consonantal sounds, like the Spanish *ñ*, *ll*, *rr*, the German *kn*, *pf*, the Russian *schtsch*, the Italian *zz*, *cc*, etc., should find no place. Of all the Aryan languages the pure Castilian Spanish comes the nearest to such an ideal phoneticism, and it approaches very near indeed, a few consonantal heresies and the accent being its only drawbacks.

In the written alphabet of such a language there should be, and there would be no occasion for, any diacritical marks whatever. The so-called Latin or Roman handwriting and type should be employed, but with the omission of every sign which would require the writer to take his pen from the paper in the middle of a word, or else return to it in order to complete it. Hence the *i* should have no dot (as is the case in German) nor the *j*, and the *t* should not be crossed. No accents should be needed and no apostrophes.

The sounds of the language should not only be easy; they should also be fairly agreeable to the ear, and combinations should be sedulously avoided which in any of the leading tongues have indecorous or degrading associations.

Brevity is of great importance, and each word should be reduced to its simplest discriminative sound, consistent with sonorousness and lucidity.

II. *Lexicography.*—The vocabulary of the universal language should be based primarily on the vocabulary which is common to the leading Aryan tongues. There are 1500 words in German which are almost or quite the same in English; there are more than this number common to English, French, Italian and Spanish. A selection should be made from these similar or identical word-forms as the foundation of the lexicon. At least a thousand words in common use will be found to be the same in all these languages, when we allow for the operation of simple and well-known phonetic laws. Let the learner be taught these laws and he will at once know a good share of all the more usual terms of daily intercourse in this new language, and he will pronounce them correctly without a teacher, because it will contain no sound which is strange to his ears, and each word would be spelled as it is pronounced.

This existing common property of words, once assorted and presented in the orthography above set forth, would form one element of the lexicon; another will be those words obtained from an international

scientific terminology, to be decided upon by the committees of international congresses, appointed for that purpose.

Commercial and business terms are already largely the same, and there would be little difficulty in obtaining a consensus of opinion about them which would prevail, because it is of direct pecuniary advantage to business men to have such a uniformity.

There remain the terms in art, literature, poetry, politics, imagination, etc., to be provided for. But in the opinion of this committee it does not seem desirable at this time to urge the formation of a vocabulary which would be exhaustive. Much of it should be left to the needs of the future, as observed and guided by the international committees who should have the care and direction of the universal tongue. These committees should, by common consent, hold the same relation to it that the French Academy has, in theory at least, to the French language, enlarging and purifying it by constant and well-chosen additions. As in France, each writer would enjoy the privilege of introducing new terms, formed in accordance with the principles of the tongue, and such terms would be adopted or not, as they should recommend themselves to other writers in the same field.

III. *Grammar*.—By far the greatest difficulty is presented by the formal or grammatical features of such a proposed tongue.

We may best approach this part of our task by considering how the grammatical categories, or "parts of speech," as they are called, are treated in the various Aryan tongues, and selecting the simplest treatment, take that as our standard.

It may indeed be inquired whether in the grammar we might not profitably pass beyond the Aryan group, and seek for simpler methods in the Semitic, Turanian, African or American languages. But it is a sufficient answer to this to say that there is no linguistic process known to these remote stocks but has a parallel in some one of the Aryan dialects; and if such a process is very slightly developed in these dialects, this is probably the case because such a process has been found by experience to be unsuited to the modes of Aryan thought.

Returning to the grammatical categories or parts of speech, we find them usually classified as nine, to wit: articles, noun, pronoun, adjective, verb, adverb, preposition, conjunction, interjection.

The last of these, the interjection, is of no importance, and as for the first of them, the article, we find that the Latin and the Russian move along perfectly well without it, and hence we may dismiss it whether article definite or article indefinite, as needless in the universal language.

The adjective in Latin has gender, number and case, and in most living Aryan languages has number and gender; but in English it has neither, and, therefore, true to the cardinal principles of economy in the formal portions of speech, in the universal language it should

have neither. More than this, in colloquial English and German, and always in English in the comparative degree, there is no distinction between the adjective and the adverb; and upon this hint we perceive the inutility of the distinction and dismiss it as operose only. The comparison of adjectives should be by words equivalent to *more* and *most*, as is practically the case in the Romance languages, and never by comparative and superlative terminations, as in English and German, as our endeavor should always be to maintain the theme unchanged.

This reduces our nine parts of speech to six, which are proved to be enough, by the facts quoted.

The noun in German undergoes changes for gender, number and case. Of these the gender in all Aryan tongues except English and modern Persian, is an absurdity, without application to the object, and a most serious impediment to learners. Grammatical gender, therefore, should be absolutely dismissed, and material gender expressed by the feminine adjective of sex, as in English and most American languages (bear, she-bear, rat, she-rat, etc.).

The Greek has a singular, a dual and a plural number. The dual has dropped out of modern tongues, and in many instances the plural is grammatical only and not material. Indeed, as in most American languages, so often in English and German, the plural form is not used even when the plural number is meant. Thus, we say, ten head of steers, six dozen herring, sechszehn Stück Cigarren, sechs Uhr Abends, etc. It is probable, therefore, that both gender and number could be usually dispensed with in nouns.

With regard to the case of nouns, it will be observed that the tendency of all the Teutonic and Romance languages has been to get rid of them. French and Spanish have succeeded completely; the English retains the genitive; the German the nominative, genitive, dative and accusative, in some instances. The cases have been supplied by the use of pronouns and prepositions, and we shall be wise to respect this tendency as indicative of linguistic progress. It is historically clear that to attempt to restore the case endings of nouns would be to steer directly against the current of linguistic evolution. There has even been an effort both in English and German to dispense with the genitive by substituting a possessive pronoun for the case ending, as "John his book," "Ludwig sein Pferd;" while the Berlin dialect of the lower classes has often but one termination for both genitive and dative, where pure German has two.

The use of the possessive pronoun to indicate the genitive is simple and logical; it prevails in most American languages and most jargons; and is quite adapted to the end. In fact, some dialects, such as the French Creole of Trinidad, Martinique and St. Thomas, contain no pronominal adjectives, and make out very well by placing the personal pronoun like any other attributive case, after the noun, as *liv li*,

"his book," literally "book he." It might be queried whether the universal language would not gain in ease and simplicity by adopting this method of placement.

The dative, or *régime indirecte*, could be supplied in a similar manner by a pronoun in an oblique form. There is no necessity for more than two oblique cases of the pronoun, and they can be added to all nouns as a substitute for prepositions, when needed for clearness.

The pronouns of the modern tongues, and especially of their colloquial dialects, demonstrate that the relative, interrogative and demonstrative forms can be blended without loss of lucidity. The German *der*, the English *that*, are both relative and demonstrative; the French *qui* and *ça* are both relative and interrogative in Creole.

The reflexive pronoun is used very unnecessarily in most modern Aryan tongues. There is no logical propriety in the French *Je me casse le bras*. The use of such a form should be greatly restricted.

The verb has tense and mood, number and person. It is conjugated in all Aryan languages sometimes regularly, sometimes irregularly, and it has many forms. In studying its history, however, no one can overlook its steady tendency toward simplification of the form of the theme and the adoption of the periphrastic method of conjugation, or that by auxiliaries. By this process the verb loses all inflections and is reduced to a single form; person and number are expressed in the subject, tense and mode by auxiliaries. This should be the process adopted by the universal language, with perhaps the exception that the simple past and future might be expressed by terminations, every verb being absolutely regular. The future termination is now lost in English and German, and even the past termination is often dispensed with in both tongues, as "I give," "I did give," "ich that geben;" but as both are vigorous in the cultivated Romance tongues, these formal elements might be conceded.

A very delicate question relates to the substantive verb, "to be." Shall we omit it or express it? The Latin rarely introduces it, and there are numerous tongues in which it has no equivalent. On the other hand, modern Aryan speech has developed it markedly; the Spanish has its *ser* and *estar*, the German its *sein* and *werden*, expressive of shades of meaning included in our verb "to be." This prominence of the expressions for existence seems to be connected with marked psychological advances, and a ripening self-consciousness, as has been lately set forth by a profound French critic of language, M. Raoul de la Grasserie. We should be inclined, therefore, to respect this expression, and allow it in a universal language the prominence it enjoys in most Aryan tongues of modern type.

The prepositions offer great difficulties in modern languages. The most of them can be omitted by making all verbs which have an active meaning govern their object directly, and have the direct object follow the verb and the indirect object placed later in the sentence. The

phrase, "give to the child a spoon," would be just as intelligible in the form " give spoon child," if we remember that the direct precedes the indirect object.

The simplification of grammatical forms here proposed involves an equal simplification in syntax, and this is an enormous gain. But it involves also the loss of freedom of position, so conspicuous a feature in Latin, and by some so highly esteemed. But philosophically considered, this freedom of position is solely a rhetorical and artistic gain, not a logical superiority. Grammarians even of the classical tongues are perfectly aware that there is a fixed logical arrangement of words in a sentence, and this, and this alone, is the only arrangement which a universal language should adopt. This arrangement may be briefly given as follows: Subject before predicate ; noun before its adjective; verb or adjective before qualifying adverbs, immediate object before remote object. This is the logical course of thought and should be the universal form of expression. It was a dubious advantage to the Greeks and Latins that their numerous inflections permitted them to disregard it.

Those languages which rely largely on position obtain rhetorical grace by a recognized value assigned to alterations of position; and this would apply equally to the scheme proposed.

Other questions will arise in the projecting of a universal language. Shall we adopt postpositions as well as prepositions? Shall we indicate inflections by internal vowel changes? Shall we have free recourse to affixes, suffixes and infixes? Shall we postfix conjunctions, like the Latin? Shall we manufacture entirely new roots from which to form new words and derivatives?

To all these questions your committee replies with an emphatic negative. All such processes are contrary to the spirit which has pervaded the evolution of the Aryan languages for the last two thousand years, and their adoption would violate the indicated rules for the formation of a universal Aryan speech.

III.

In applying the principles which have been above set forth to the creation of the Rev. Johann Martin Schleyer, we find something to praise and much to condemn in his attempt.

Mr. Schleyer first published a sketch of his proposed universal language in 1878, and the first edition of his grammar in 1880. It has been welcomed with applause in Germany, and efforts have been made with some success to introduce it into France, England and America.

His scheme is evidently the result of conscientious labor and thought, and he manifests a just appreciation of the needs of the time; but unfortunately the theory of construction he has adopted is in conflict with the development of both the Teutonic and Romance languages, and full of difficulties to the learner.

Beginning with its phonetics we find that he has retained the impure German modified vowels *ä*, *ö*, *ü*, the French j (*dsch*), as well as the aspirated *h* or rough breathing. He has eight vowels and nineteen consonants where five vowels and sixteen consonants should suffice; elsewhere he extends his alphabet to thirty-seven letters. He also introduces various diacritical marks indicating accent, tones, vocal inflection and quantity, all of which we consider needless and obstructive. Double consonants are numerous, and the *Volapük* is both written and printed with underscoring and italic letters, necessary to facilitate its comprehension.*

The lexicography is based largely on the English, about 40 per cent of the words being taken from that tongue, with phonetic modifications. These modifications do not regard the other Aryan languages, and various sounds of the Volapük alphabet could not be pronounced by a member of any Aryan nation without special oral teaching. This we regard as a fatal defect.

Moreover, many words are manufactured from entirely new radicals, capriciously, or even fantastically formed, and this we condemn.

The article is omitted, which is well; but the nouns are inflected through a genitive, dative and accusative case, and a plural number. The signs of these cases are respectively *a*, *e*, *i*, and of the plural *s*.

Diminutives, comparatives and superlatives are formed by prefixes and suffixes, and on the same plan adverbs are formed from adjectives, and adjectives from nouns. Thus, *silef*, silver; *silefik*, silvery; *silefikiim*, more silvery; *silefikiin*, most silvery; *silefiko*, silverly. It will be observed that while this process is not dissimilar to that once frequent in the Aryan stock, it is not analogous to that which the evolution of that stock indicates as its perfected form.

In the conjugation the subject follows the verb, *bin—ob*, I am; where *bin*=am, *ob*=I. This we object to as contrary to the logical arrangement of the proposition. We are surprised to see the German third person plural (*Sie*) retained by the author as a "courteous" form. It should be the first duty of a universal language to reject such national solecisms.

The tense is indicated by prefixes, *a*, *e*, *i*, for the imperfect, perfect, and pluperfect active, *o* and *u* for the two futures.

The passive voice has the prefix *p*, the subjunctive by the suffix *la*, the optative and imperative by the suffix *ös*, the infinitive by the suffix *ön*. Abstracts are formed by adding *äl*, as *mon*, money; *monäl*, love of money, avarice. These suffixes are to be placed in fixed relations to the root, and hence often become infixes.

The excessive multiplication of forms lends to *Volapük* an appearance totally un-Aryan. The verbal theme is modified by sixteen suf-

* These remarks are based upon the seventh edition of Schleyer's *Mittlere Grammatik der Universalsprache* Volapük (Konstanz, 1887).

fixes and fourteen prefixes. There are a "durative" tense, and a "jussive" mood, conjunctive, optative, gerund and supine forms, all indicated by added syllables, reminding one of the overloaded themes of Turanian tongues. This mechanism is not only superfluous, but if any lesson may be learned from the history of articulate speech, it is precisely the opposite to what the universal language should and must be.

The meaning is largely derived from placement, as will be seen in the following example, in which *gudikos* is the neuter adverbial noun "goodness," das Gute; *plidos*, from English "please," the third singular indicative.

Gudikòs plidös Godè.
Goodness pleases God.
Plidos Gode gudik.
It pleases God the good (the good God).
Plidòs gudìk Gode.
It pleases well God.

And so on. It is acknowledged by the author that obscurities may easily arise from these transpositions, and there is much dependence on accents and tones.

From this brief comparative examination of the evolutionary tendencies of the Aryan tongues and the scheme of a universal language as offered in the works of Mr. Schleyer, it is plainly evident that the two are in absolute opposition.

Volapük is synthetic and complex; all modern dialects become more and more analytic and grammatically simple; the formal elements of Volapük are those long since discarded as outgrown by Aryan speech; its phonetics are strange in parts to every Aryan; portions of its vocabulary are made up for the occasion; and its expressions involve unavoidable obscurities. With an ardent wish for the formation and adoption of such a universal tongue, and convinced as we are that now is the time ripe for its reception, we cannot recommend Volapük as that which is suited to the needs of modern thought. On the contrary, it seems to us a distinct retrogression in linguistic progress. Nor in this day of combined activities does it appear to us likely that any one individual can so appreciate the needs of civilized nations as to frame a tongue to suit them all. Such a task should be confided to an international committee from the six or seven leading Aryan nationalities.

In conclusion, your committee would respectfully suggest that it would eminently befit the high position and long-established reputation for learning of the American Philosophical Society, to take action in this matter, without delay, and to send an official proposition to the learned societies of the world to unite in an interna-

tional committee to devise a universal language for business, epistolary, conversational and scientific purposes. As the time once was when the ancestors of all Aryans spoke the same tongue, so we believe that the period is now near when once again a unity of speech can be established, and this speech become that of man everywhere in the civilized world for the purposes herein set forth.

Your Committee therefore offers the following resolution:

Resolved, That the President of the American Philosophical Society be requested to enclose a copy of this Report to all learned bodies with which the Society is in official relations, and to such other societies and individuals as he may deem proper, with a letter asking their co-operation in perfecting an international scientific terminology, and also a language for learned, commercial and ordinary intercourse, based on the Aryan vocabulary and grammar in their simplest forms; and to that end proposing an international congress, the first meeting of which shall be held in London or Paris.

D. G. BRINTON, *Chairman*,
HENRY PHILLIPS, JR.,
MONROE B. SNYDER,
Committee.

Supplementary Report of the Committee appointed to Examine into the Scientific Value of Volapük, etc.

The former Report having been recommitted, your Committee avails itself of the opportunity to explain more clearly the aim of the previous paper, to meet some of the objections offered against particular statements, and, at the request of several members, to enlarge the scope of the Report, so as to embrace a brief consideration of the two other universal languages recently urged upon the public, the "Pasilengua" of Steiner, and the "International Language" of Samenhof.

The aim of the Committee was strongly to urge the desirability of taking immediate steps to establish a universal language, both for learned and general purposes. These steps, it asseverated, should be taken by the learned world as a body; the form of language adopted should be endorsed by the scientific societies of all nations; by their recommendation it should be introduced into schools and universities, and competent private teachers would soon make it familiar to all who would have occasion to use it. The Report distinctly states (p. 4) that it is in nowise expected that this international language will supplant any existing native tongue. It is to be learned *in addition* to the native tongue, and not *in place* of it.

The aim of the grammatical portion of the Report was simply to maintain three theses; first, that the pronunciation of the proposed tongue should be so simple that it could be learned by any one speaking

an Aryan language, without the necessity of oral instruction; secondly, that its grammar should be simplified to the utmost; and thirdly, that its lexicon should be based on the large common property of words in the Aryan tongues.

Your Committee repeats and insists that these are the indispensable requisites to any such proposed international tongue. It does not insist that the individual suggestions and recommendations contained in the report should be urged at all hazards. They were advanced rather as hints and illustrations, than as necessary conditions. Nevertheless, they were not offered hastily, and your Committee desires to refer to some of the main arguments advanced against them. This it is prepared for the better, through the complaisance of Professors Seidensticker and Easton, who have forwarded to the Committee, at its request, abstracts of their remarks.

Both these very competent critics attack the principle of deducing the grammar of the proposed language from the latest evolution of Aryan speech, to wit: the jargons. Professor Seidensticker accuses such a grammar of "poverty," and adds: "A higher organism is of necessity more complex than a lower one." Professor Easton denies that the later is the better form; or, to use his own words, "that the change from an inflected to an analytic tongue marks an advance in psychologic apprehension."

These criticisms attack a fundamental thesis of your Committee, and as they doubtless express the views of very many, they must be met.

In our opinion, they rest upon a radical misconception of the whole process of linguistic evolution. The crucial test of the development of language is that the sentence shall express the thought intended to be conveyed, and *nothing more*. When this can be attained simply by the order of words in the sentence, without changes in those words, such changes are not merely useless, they are burdensome, and impede the mind. All paradigmatic inflections, whether of nouns, adjectives or verbs, are relics of lower linguistic organization, of a barbaric condition of speech, and are thrown aside as useless lumber by the active linguistic faculty in the evolution of jargons. Compare a simple Latin sentence from Cicero with its translation into English, which is a jargon of marked type, and note how much is dropped, and with what judicious economy: *Romanis equitibus literæ afferuntur*. "Letters are brought to the Roman Knights." One word here will serve to illustrate all. In Latin the speaker must think of the adjective *Romanis* as masculine, not feminine, or neuter; as plural, not singular; as a dative, not a nominative, accusative, or vocative form; as agreeing in all these points with the noun it qualifies; and finally, as of the first, and not of the second, third, or of some irregular declension. All this needless labor is saved in the English adjective *Roman* by the method of position or placement. And so it is with every other word in this sentence. The evidence, both from theory and from history, is conclusive that

the progress of language, linguistic evolution, means the rejection of all paradigms and inflections, and the specialization of the process of placement.

Professor Easton maintains that this method (that of placement) "introduces an element of great difficulty into the language, and also doubts the acceptance of the logical order stated in the Report.

To the first of these objections the obvious answer is that the method of placement is that uniformly adopted in all jargons and mixed tongues, which is positive proof that it is the least difficult of any method of expressing relation. As to the logical order referred to by the Committee, it is surprising that any exception should be taken to it, as it is that stated in the common classical text-books.

Some related minor points remain to be noticed. In opposing vocal inflection signs and accents, on p. 5 of the Report, the Committee referred only to the written, not to the spoken language. The phonetic formation proposed is insisted upon only to the extent that no sound should be introduced which would be strange to the six leading Aryan languages. The substitution of placement for prepositions, recommended on page 9, was meant as illustrative merely. The particular statement that the Berlin dialect (of the lower class) has but one termination for both genitive and dative is upon the authority of Dr. and Mrs. Seler, of Berlin, the former a professed linguist, the latter born and raised in that city. The question whether in the German expression, *sechs Uhr Abends*, the word *Uhr* is a singular form with a plural meaning, is contradicted by Professor Seidensticker; but in view of the strictly analogous Spanish expression, *las seis horas de la tarde*, the Committee maintains its original opinion.

Passing from these specific animadversions, there were some general objections which should be answered. Various speakers maintained that the project of an international language is impossible of realization; others asserted that it was unnecessary; others that even if realized, such a tongue could have no figurative or artistic wealth of resources.

To these strictures it is replied that within eight years Volapük is claimed to have acquired one hundred thousand students; within a month it has attracted attention all over the United States; within a week a number of German merchants have announced to their foreign correspondents that in future it will be used in their business communications. If this is the case with so imperfect a language, backed by no State, no learned body, not even by the name of any distinguished scholar, what would be the progress of a tongue perfect in adaptation, and supported by all these aids to its introduction? In a decade it would be current among ten million people. That it would be barren in figurative meanings, or sterile in the expression of the loftier sentiments, is inconceivable, because, formed, though it would be, of deliberate purpose, the inherent, ever-active, linguistic faculty of the

race would at once seize upon it, enrich it, mould it, and adapt it to all the wants of man, to the expression of all his loves and hates, his passions and hopes.

Your Committee closes with a reference to the remaining two tongues now claimants for universal adoption.

The "Pasilengua" (*Gemeinsprache*, "Tongue of All") was introduced by P. Steiner, in 1885, with a small grammar and dictionary, published in German. The "International Language" of Dr. L. Samenhof, of Warsaw, is an arrival of the present year, and is explained by him in a small volume, issued in French, in his native city, under the pseudonym of "Dr. 'Esperanto."

Both these have pursued the correct path in the formation of their vocabulary; they both proceed on the plan of collecting all words common to the leading Aryan languages, changing their form as little as possible consistently with reducing them to an agreeable phoneticism, and when the same word has acquired diverse significations, selecting that which has the broadest acceptation. The plan of Dr. Samenhof is especially to be recommended in this respect, and may be offered as an excellent example of sound judgment. It is remarkable, and remarkably pleasant, to see how easy it is to acquire the vocabulary of either of these writers, and this is forcible testimony how facile it would be to secure an ample and sonorous stock of words, practically familiar to us already, for the proposed Universal Tongue.

Unfortunately, the alphabets of both employ various diacritical marks and introduce certain sounds not universal to the leading Aryan tongues. These blemishes could, however, be removed without much difficulty.

It is chiefly in the grammar that both err from the principles strenuously advocated by your present Committee. The Pasilengua has an article with three genders, *to*, *ta*, *te*, corresponding to the German *der*, *die*, *das;* it has also three case endings to the noun, besides the nominative form, which itself changes for singular and plural, masculine and feminine. In the verb the tenses are formed by suffixes, six for the indicative, four for the subjunctive; while a number of other suffixes indicate participles, gerunds, imperatives, etc.

In the same manner, Dr. Samenhof expresses the relation of the elements of the proposition in the sentence "by introducing prefixes and suffixes." "All the varying grammatical forms, the mutual relation of words to each other, are expressed by the union of invariable words" (*Langue Internationale*, p. 13). He acknowledges that this is "wholly foreign to the construction of European [he means Aryan] languages," but claims that it yields a grammar of such marvelous simplicity that the whole of it could be learned in one hour. In reality, it is what is known to linguists as the agglutinative process, and is found in the Ural-Altaic tongues, in high perfection.

It will be seen at once that the grammatic theories of both these

tongues are directly in opposition to that advocated in the present and the previous Reports. These are both distinct retrogressions to an earlier, less developed, and more cumbersome form of language than that which dispenses with paradigms and inflections of all kinds.

Nevertheless, these repeated efforts go to show that an international language is needed, that it is asked for, that it is coming, and justify the propriety of this Society, which as far back as the second decade of this century marked itself as a leader in linguistic science, taking the van in this important and living question.

After discussion, during which amendments to the resolution originally proposed by the Committee were offered by Prof. Cope and Mr. Dudley, the Society adopted the following resolution by an unanimous vote:

Resolved, That the President of the American Philosophical Society be requested to address a letter to all learned bodies with which this Society is in official relations, and to such other societies and individuals as he may deem proper, asking their coöperation in perfecting a language for learned and commercial purposes based on the Aryan vocabulary and grammar in their simplest forms; and to that end proposing an International Congress, the first meeting of which shall be held in London or Paris.

The death of Prof. F. V. Hayden was announced December 22, 1887, æt. 60, and the President was authorized to appoint a suitable person to prepare the usual obituary notice.*

The Secretaries read the report of the Judges and Clerks of the Annual Election held this afternoon for Officers and Council, stating that the following had been duly elected:

President.

Frederick Fraley.

Vice-Presidents.

E. Otis Kendall, W. S. W. Ruschenberger, J. P. Lesley.

Secretaries.

George F. Barker, Daniel G. Brinton, Henry Phillips, Jr.,
George H. Horn.

* Prof. J. P. Lesley subsequently appointed.

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Councilors for three years.

Aubrey H. Smith, J. Cheston Morris, Edward D. Cope,
George R. Morehouse.

Curators.

Charles G. Ames, John R. Baker, Philip H. Law.

Treasurer.

J. Sergeant Price.

On motion of Mr. Dudley, Henry Phillips, Jr., was nominated for Librarian and the nominations were closed.

Prof. Philip R. Uhler, of Baltimore, read a paper on "The Albirupean formation and its nearest relatives in Maryland." In the discussion following, Prof. Lewis and Prof. Heilprin differed from the writer in their views of the age of the formations to which he referred, Prof. Lewis considering them Silurian, and Prof. Heilprin as Palæozoic and not Mesozoic.

The reading of new nominations Nos. 1173, 1174 and 1175 was postponed to the next stated meeting.

The communication from the Pennsylvania Commission on Amended Orthography was taken up, and on motion of Mr. DuBois, the President was authorized to appoint at his leisure a committee of three members to consider the subject referred to and to report the same to the Society.*

And the Society was adjourned by the President.

* Messrs. DuBois, Phillips and MacAlister subsequently appointed.

THE PHYSICAL PHENOMENA

OF

HARBOR ENTRANCES.

THEIR CAUSES AND REMEDIES.

DEFECTS OF PRESENT METHODS OF IMPROVEMENT.

By Lewis M. Haupt, C.E.
(*Professor of Civil Engineering, University of Pennsylvania, Phila.*)

This Paper was awarded the Magellanic Premium at a Stated Meeting of the American Philosophical Society, held December 16, 1887.

Every well-considered plan for improving the entrance to a harbor must take into account the existing physical conditions or features of the site, and the causes which have produced them. These features are composed of the land-drainage, the inner basin, the gorge, the outer basin, the bar and the ocean. In passing from the fresh to the salt water system, there may be one or more channels having some peculiar characteristics, which are not mere accidents, but the results of certain forces. Before any radical or permanent improvement can be effected it is necessary that the forces operating at any point should be fully understood, and, so far as possible, be measured. In tracing step by step the causes from their effects, I have found the circle of investigation unavoidably widening, until it embraced many of the physical phenomena pertaining to the North Atlantic Ocean.

The initial point in this study is the form of the bed or mould of alluvial harbors, supposed to be of material sufficiently plastic to reveal the effect of the forces operating upon them. I have heretofore elsewhere called attention to the important deductions to be obtained from noting the position of

the submerged crest line of bars, as well as from the relative slopes of sections along the thalweg of the channel or across the bar, as indicating the direction of movement of the sand and of the flexure of the outer ends of the channels, after passing the gorge, either up or down the coast. The immediate cause of this flexure was asserted to be a littoral component which *rolled up the sand on the flood tide and compressed the ebb stream against one or other of the adjacent shores.* But why this resultant should have been so constantly operating in opposite directions at different entrances was not then fully understood or stated.

It is the object of this paper to collate certain observed facts, for the purpose of explaining these phenomena and of deducing therefrom a conclusion of practical value in the economical solution of the problem of improving our harbor entrances.

Typical Forms. (See Plate I.)

In examining the plan of any entrance it is generally found that the ends of the islands forming the outlying cordon are elongated into spits or hooks, curving inward, with a smooth outer and a rugged inner shore line; that one of the points is sharp, and the other blunt or round headed; that the sharp point usually recedes from the general coast line; that the seaward slope of a cross section of the bar is less steep than the inner slope, except where the ebb streams cross it; that the flood tide usually approaches the entrance at first in a direction more nearly parallel to the sharper lip and normal to the blunt one, rolling up the gentler slope and depositing sand on or within the crest of the bar, where "breakers" are found; that along the shore of the sharp point there is a shallow channel cut out by the flood, and curving around the blunt, projecting lip of the gorge there is the main deep-water chan-

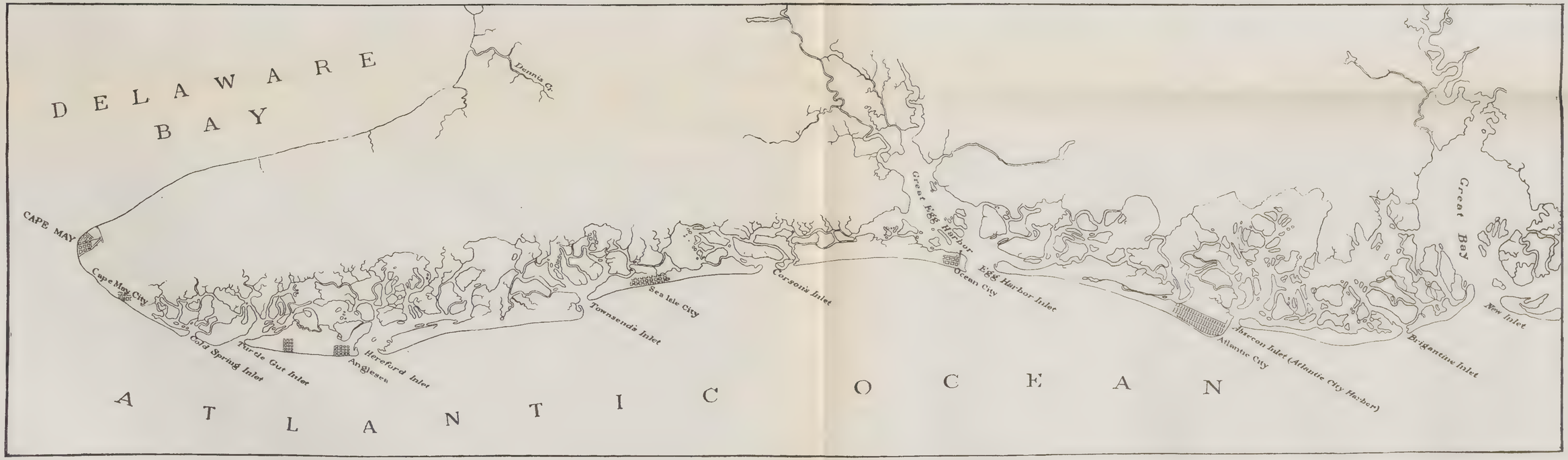

DELAWARE
BAY
Dennis C.
CAPE MAY
Cape May City
Cold Spring Inlet
Hurdle Gut Inlet
Hereford Inlet
Anglesea
Sea Isle City
Townsend's Inlet
Corson's Inlet
Great Egg Harbor
Ocean City
Egg Harbor Inlet
Great Bay
Absecon Inlet (Atlantic City Harbor)
Atlantic City
Brigantine Inlet
New Inlet
ATLANTIC OCEAN

PLATE I.

nel produced by the ebb. Between these limits are found one or more secondary or swash channels, which provide egress for the lateral overflow, so to speak, of the ebb and correspond to the waste weirs or crevasses of a stream.

Charleston Harbor.

These characteristics are well illustrated in the harbor of Charleston, S. C., as seen on the chart of 1858 (Fig. 1). I have selected this early date as it shows the current movements and condition of channels before extensive improvements were begun. Here the thalweg approaches the gorge in a direction nearly east and west, and on passing out it is deflected fully 90°, and extends nearly north and south. Hugging the northern spit is the flood channel, known as Maffit's or Sullivan's Island channel, with nine (9) feet on its crest at the *inner* end. Then appear the breakers of Drunken Dick shoal, followed by the weir channels known as the North channel, with ten (10) feet at its *outer* end; the swash channel, nine (9) feet; the main ship channel, eleven (11) feet, and Lawford's channel, ten (10) feet.

The shortest distance to the outer eighteen (18) feet contour from the gorge is three and one-fourth ($3\frac{1}{4}$) statute miles, whilst by the main ship channel courses it is *seven* (7) miles, or more than double, so that vessels entering from the north must make a detour of nearly fourteen (14) miles to cross the bar.

At the only current station outside the bar the set of the flood during the first and second quarters (its most energetic period) is *parallel to the shore* of Sullivan's Island, or about west south-west, but it swings around through west to nearly north-west, or normal to the gorge during the last quarter. The stations inside of and on the bar show

local modifications of the flood and a movement towards the entrance, due to the diminution of resistance in that direction, especially during the last quarters of the flood. The plane of maximum ebb scour, as indicated by the depth of water on the bar, is limited to about twelve (12) feet.

Similar features will be noticed at Galveston (Fig. 2) and at other entrances, but it does not always happen that the crossing of the bar is so far from the gorge, nor is it always to the south. The position of this important point is the resultant of the internal and external forces which affect the movement of the main ebb stream.

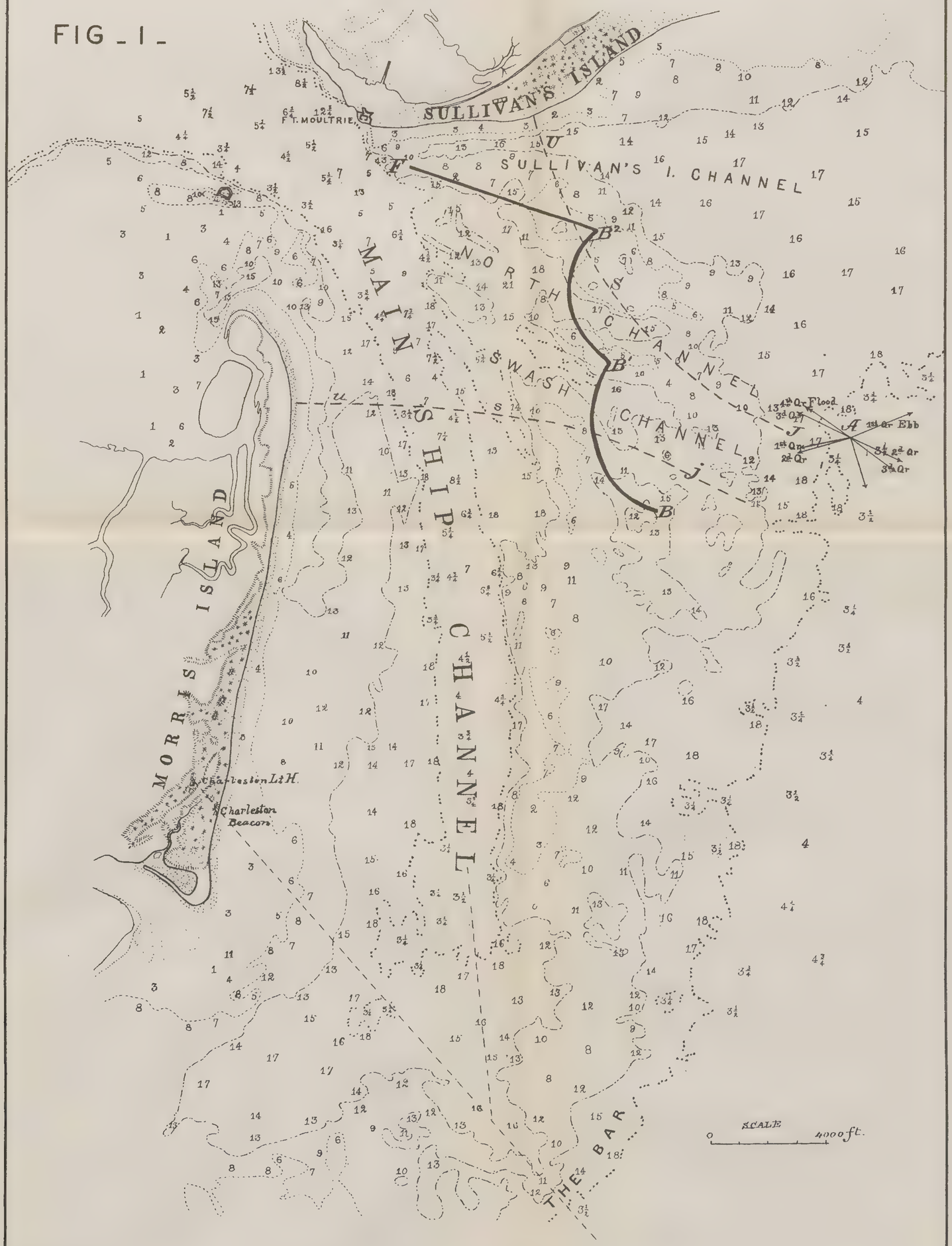
The Forces.

The *internal* forces are those resulting from the form and extent of the inner basin, the volume of the tidal prism and the relative directions of the tidal and river currents as they approach the gorge. The *external* effects are those resulting from the form, position and extent of the banks which have been piled up by the flood and obstruct the ebb. Hence it follows, if the flood pressure and movement is from the south side of the entrance the channel will be to the north, as the banks will be more extensive on the former side, offering greater resistance and deflecting the ebb stream and crowding it in until it is supported on its opposite flank by the shore. If the flood resultant comes in from the northern side, the reverse is true.

Again, if the confluent ebb streams of the inner basin are so directed by natural or artificial constructions as to commingle and unite their energies, instead of opposing one another, as most frequently occurs, the momentum of the united stream will be greater and the crossing on the bar be consequently deepened. This will be better understood by observing that the inner

Entrance to Charleston Harbor, S.C.

FIG - I -



Entrance to Galveston Harbor, Texas.

FIG - II -

basin is generally composed of three subdivisions, viz: One extending along the islands on either hand, and one stretching to the rear. At the ebb of the tide the prisms of discharge are all approaching the gorge at the same time. In consequence. of the inward flexure of the spit at this place, one or both of the lateral currents are reflected into the face of the main discharge, and thus diminish its energy, which it is the object of the engineer to conserve.

These general effects can be seen by a comparison of the position and depth of the bar crossings along the coast line of the Middle and Southern States. One of the most striking and typical instances of the effect of the internal concentration and conservation of energy is that of the *Port Royal* entrance, where there is a depth of twenty-one (21) feet on the bar, due to the increased intensity of the resultant ebb, produced by the confluence of the Beaufort, Broad and Chechessee rivers, whose thalwegs approach in directions nearly parallel. Here, too, is observed the flexure of the outer stream to the southward, showing clearly the existence of an excess of flood action from the northward, and the piling up of sand banks on this side to be eroded by the ebb.

The opposite effect resulting from conflicting internal currents is il'ustrated in the case of the Galveston entrance (Fig. 2).

An examination of the various entrances leaves no doubt of the existence of such a littoral flood movement, whereby the sands of the beaches are transported to and deposited in front of the inlets, where the racing waves, no longer resisted by and reflected from the shore, escape through the break in the barrier which forms the outlying sandy cordon defending the coast.

Ocean Dynamics.

The effect of this racing of the waves in search of an escape from the pressure of the flood tide is to scour off and prolong the sharper lip at the gorge and to flatten out and beat back the opposite shore, thus shifting the position of the "inlet" until in some instances it is transported considerably to one side of the medial line of the inner bay, or entirely closed. Thus, the position of the thalweg is made to cross the gorge obliquely, and furnishes additional evidence of the resultant direction of the external or flood movement. *These movements are fully illustrated in the comparative chart herewith submitted of Barnegat Inlet (Plate IV), from which it is seen that the flood resultant comes in from the north, prolonging and eroding the northern spit compressing the ebb against the lighthouse shore, from which it has cut away so great a volume as to seriously endanger the structure. The total movement in about thirty-four (34) years has been half a mile, or about eighty (80) feet per year. Had this action been previously recognized the lighthouse would probably not have been placed in so dangerous a position, but on the north spit. During the prevailing north-east winds of this spring the encroachments have been more rapid and extensive than at any previous time. The remedy is apparent, but will be stated generally further on in this communication. The effort of the ebb is not to oppose the flood resultant directly, but to turn away therefrom and assume a direction as nearly as may be at right angles thereto.

Thus the flood will roll the sand up the gentler outer slope to the crest in a direction normal to the main channel, while the ebb will sweep across its path on the line of least resistance,

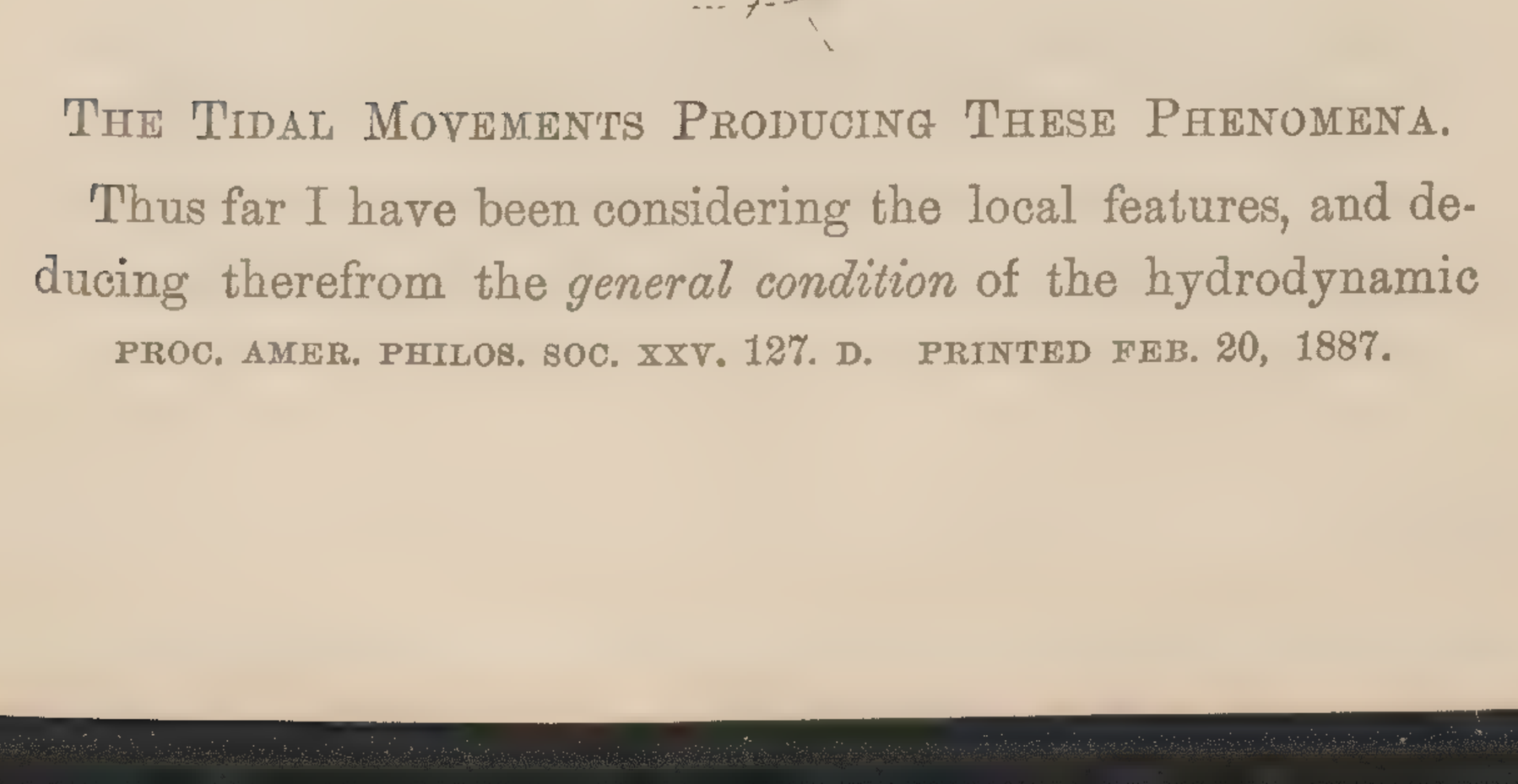
*This paragraph was interpolated here after the paper was written. See Supplement.

which lies behind and parallel to the barricade formed by the flood, and effect *its maximum result at the point of minimum resistance*, which is that point of the bar farthest removed from the direct action of the flood. This enceinte formed by the flood is also the cause of the beach channel lying under the near spit, since a portion of the flood is deflected by the bar into the re-entrant between it and the shore, whilst another portion is rolled along the beach, and these two components unite in a resultant cutting across the inner angle of the bar and carrying silt into the gorge.

The action of these forces may possibly be made clearer by reference to a simple diagram:

A. Point of maximum flood force.

B. Point of minimum flood resistance.



The Tidal Movements Producing These Phenomena.

Thus far I have been considering the local features, and deducing therefrom the *general condition* of the hydrodynamic

forces which have produced the observed effects. It now remains to determine why this resultant should be sometimes from the north-east and at other times from the south-east. This leads at once to an examination of the phenomena attending the approach of the tidal wave and the position of the cotidal lines with reference to the coast line. For this purpose there are available the general cotidal maps of Prof. Guyot, and the more detailed maps of Prof. Bache, accompanied by the tide tables of the Atlantic coast, as contained in the United States Coast Survey Reports. Meagre as these data are, they are yet sufficiently abundant to confirm the existence of the alleged resultant movements, and to verify in the most satisfactory manner the reliability of this method of determining the forces by their effects.

Although the phenomena of tidal movements in the open ocean are but little understood, it is well known that they are sensibly modified by the topography of the coast line.

Professor Bache says that "where a bay or indentation of the coast presents its opening favorably to the tidal wave and decreases in width from the entrance towards its head, it is well known that the tides rise higher and higher from the mouth upwards," while Lentz, in his "Ebb and Flow of the Tides," says:

"The intricate, theoretical, tide-generating conditions are complicated by a number of circumstances, forming a bewildering labyrinth of causes and results, through which the human mind cannot find its way."

"The numberless tidal waves rushing through the ocean in all directions may be compared to those formed by throwing ten (10) or twenty (20) stones into a small pond. By watching these we may learn as much as we know about the tidal waves moving on our ocean," and he adds, "this certainly is discour-

aging, and we only know that we do not know anything." While this conclusion may be true as to the currents in the open sea, it cannot be applied to those along shore, for an examination of our coast line reveals some striking and definite features. These are, the existence of four (4) prominent salients upon which the tidal crest impinges, and by which it is broken up into components, which are deflected into the bays on either side. At the points of incidence there will generally be found large inner sounds, extensive shoals and bars, and the heavy precipitation resulting from the checking of the momentum of the wave, the change in its direction and the interference and eddies produced thereby. Then follows the comparatively smooth reach of straight beach, along which the component tidal waves travel inland from the chord joining the salient capes, and finally, the indented and serrated shore where the opposing components in the same sinus meet at the point farthest from the chord, and where the tides are highest, the marshes most extensive, and the outlying cordon of sand is replaced by numerous islands and intricate "back" channels. Here the tidal wave is brought to rest, and exerts its energy in a direction nearly normal to the coast, whilst along the flanks of the bay it is moving obliquely to the shore, but always towards the bight, except when locally disturbed, and with a dynamic energy, begotten in mid-ocean, which compresses the sand upon the shores and transports it *in the direction of that motion.*

The motor in the case of the flood tide is chiefly *universal* gravitation, which raises the crest of the flood wave from two (2) to five (5) feet, and rolls it forward upon our eastern coast line until its acquired momentum is met, modified and ultimately destroyed by the inertia of the mass of sand which it encounters.

So far as the ebb is concerned, it merely rolls off from the fore-shore, chiefly under the influence of *terrestrial* gravitation, and having its initial velocity at high-water line, its transporting energy is feeble, and it, therefore, exerts no material influence in modifying the *exterior* lines of the coast.

The Southern Bay.

These generalities are more clearly exemplified and confirmed by the facts exhibited on the accompanying chart (Plate III). Beginning at Cape Florida, the heights of the tides at the various external stations are marked in feet, whilst the cotidal lines are plotted as enlarged from the United States Survey Report of 1854.

By following the coast northwardly from Cape Florida, it will be found that the height of the tide increases from 1.5 to about 7.4 feet at Jekyl Island, between St. Simon and St. Andrew's Sounds, which is the most remote point, about two hundred (200) miles, from the chord of the arc; also, that the outer ends of the main or ebb channels are flexed northwardly, and that even the land drainage extends in the same general direction. As the bight of the bay is approached, the land discharge becomes more nearly normal to the coast and the shore line more deeply indented, and after passing this point, the tidal elevations decrease (with one exception), the directions of the land and channel discharges are reversed and the shore lines become smoother. This reach of coast is characterized by three secondary bays, separated by the groins of Cape Lookout and Cape Fear. These capes are the resultants of the opposition of the tidal wave to the fresh water discharge, which being unable to effect its escape in the face of the flood is turned to the west and south by the pressure of the

tidal component deflected from Cape Hatteras. An inspection of any general map of North Carolina reveals the fact that instead of the rivers being normal to the coast, they are turned for considerable distances back from their mouths into a direction nearly parallel with the shore line, and effect their discharge under the lee of the Cape, thus *conforming to the general law of least resistance.*

The capes and bars thus formed by the parallel and confluent fresh and salt water currents deflect the littoral component until it is met by the direct flood crest and returned to the beach near the middle point of each of the three (3) bays, Raleigh's, Onslow's and Long's. Here it is resolved into secondary littoral currents along the ellipses thus formed. The eastwardly components of these waves compress the *ebb channels against the eastern shores* of the outlets, as at Beaufort, N. C., while those to the westward, reinforced by the original wave, race along the beach, closing or shoaling the inlets and forming with the land drainage the long spits above described.

The time of high water is also much earlier outside or to the eastward of the cape than it is within, in consequence of the circuitous route required to be taken by the flood. The suction thus produced causes a draft current to the eastward, which deflects the ebb discharge from the inlets in this latter direction and increases the height of the tides inside the capes.

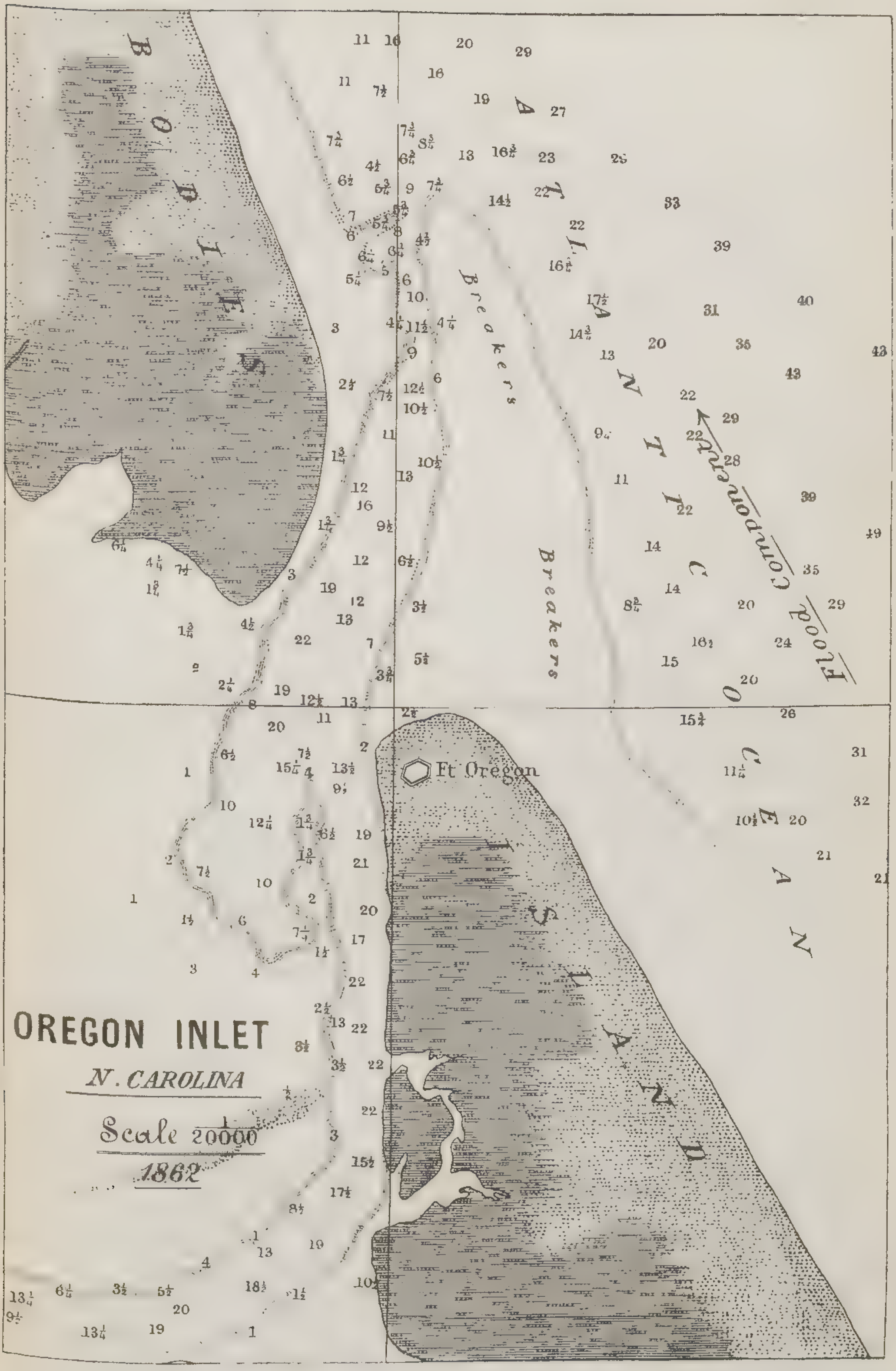
It is also a notable fact that a straight line drawn from Cape Roman to Hatteras is just tangent to Capes Lookout and Fear, and that the transverse and semi-conjugate axes of the ellipses of Long and Onslow Bays are respectively equal, while Raleigh Bay is somewhat smaller in both directions and has a steeper scarp than either of the others (due to the incident wave). The shore to the north of Cape Hatteras is deflected from the chord of the three bays produced at an angle of 45° for a dis-

tance of twenty-six (26) miles, when it again bends to the westward through an angle of 30°, and continues in an unbroken stretch of ninety-four (94) miles to Cape Henry. The only outlets on the eastern cordon of Hatteras are near the point of deflection where the northward component from the cape and the normal wave commingle.

The cotidal curve of eleven and one-half ($11\frac{1}{2}$) hour interval envelopes the cape in an arc of a circle whose radius is seventy-three (73) miles, whilst the shore line changes its direction through an angle of 74°. The limiting radii of this sector also pass through the main openings of the cordon at Oregon and Ocracoke Inlets, which are opposite the tangent points of the arc, and hence indicate the locus of the change of direction and weakening of the tidal wave. The coast line will also be found to be inclined to these radii at an angle of 80° which indicates the direction of the shore component at the points of intersection. At Ocracoke the chord of the bay lies 10° north of the tangent, and at Oregon (Plate II) 10° to the west, showing the movements to be east and north.

The velocity of the wave is greatest along the normal at Cape Hatteras and least along the radii limiting the sector. An examination of the interval between the cotidal lines shows also that the rate of movement of the general crest is considerably retarded as it approaches the shore. The twelve (12) hour crest will be seen with its flanks rolling along the receding shores of the bays, as already described. The earliest points of contact of the tidal wave are readily discovered from this chart to be at or near the points formerly indicated in this paper, whilst the latest point is at Jekyl's island, which is found by measurement to be just midway between Capes Florida and Hatteras, thus making the times of transit to this point of meeting of the flood components, equal.

PLATE II.


Ft Oregon
Breakers
Breakers
Currituck Flood
OREGON INLET
N. CAROLINA
Scale 1/20000
1862

The Middle Bay

Extends from Cape Hatteras to Nantucket, a distance of about five hundred and forty (540) miles. Its longest ordinate is that opposite the New York entrance, where it is one hundred and forty (140) miles. The shore line from Cape Henry to Sandy Hook being nearly parallel to the chord and being broken by the two large bays of Chesapeake and Delaware, there is not so great a compression of the two converging tidal components as was observed in the southern bay, yet the same general characteristics are observable.

Proceeding north from Hatteras, there is the long sandy cordon, with its smooth beach stretching in an almost unbroken curve to Cape Henry at the mouth of the bay. Here the flood wave is interrupted and deflected by the opposing Cape Charles, the outer shore line of which is deeply scored by sounds and studded with islands and shoals, created by the flood which cushions upon it. The northern component from Cape Hatteras practically terminates here and is dissipated by the bay and the islands of the outer coast as far up as Paramores Bank. In a similar manner the component rolling westerly from Nantucket, is absorbed by Long Island Sound and New York and Raritan Bays. The normal flood wave approaching the coast on either flank of Delaware Bay is resolved by the most salient points of New Jersey and Virginia into littoral components one of which travels from a point north of Barnegat, northward to Long Island. It is this component which has created and maintained Sandy Hook and which is eroding the beach at Long Branch. (The westwardly, or Long Island component has made the spit at Coney Island, and the resultant of both, maintains the flood channel under this point.) The other or New Jersey component moves towards Cape May

and builds the bars in front of Barnegat, Absecon and other inlets, crowding the channels over against the southern shores of these inlets, which are thus eroded by the ebb currents.

The same physical features will be found to result from the components acting north and south from a point near Green Run Inlet, Md., on the coast between Cape Charles and Henlopen.

The tidal observations in this bay are indicated on the map (Plate III) and confirm this theory. The mean rise of the tide at Cape Charles is only 2.5 feet, because of the relief afforded by the bay. At Cold Spring Inlet it is 4.4, and at New York entrance 4.8. Here it attains its maximum height and thence diminishes eastwardly to Nantucket. From the secondary point of reversion near Barnegat on the New Jersey coast, the littoral currents are indicated by the heights of the tides. Thus at Barnegat they are 2 feet, at Absecon 3.9, at Cold Spring 4.4, etc.

The interference of the tidal waves and the great difference of three (3) hours in the time of high water which is compressed in the short space between Martha's Vineyard and Monomoy, is too extended a subject to be included in this paper, which is intended merely for the alluvial coast line south of Long Island. Its consideration is therefore omitted, but the mean tides are recorded in part of the northern bay to illustrate the continuance of the concentration of the tidal energy and progression as previously observed.

These same laws and phenomena are found to exist on the Pacific Coast and will explain many of the effects which have only been casually noted by mariners. The phenomena are identical with those already described. The laws are of general application.

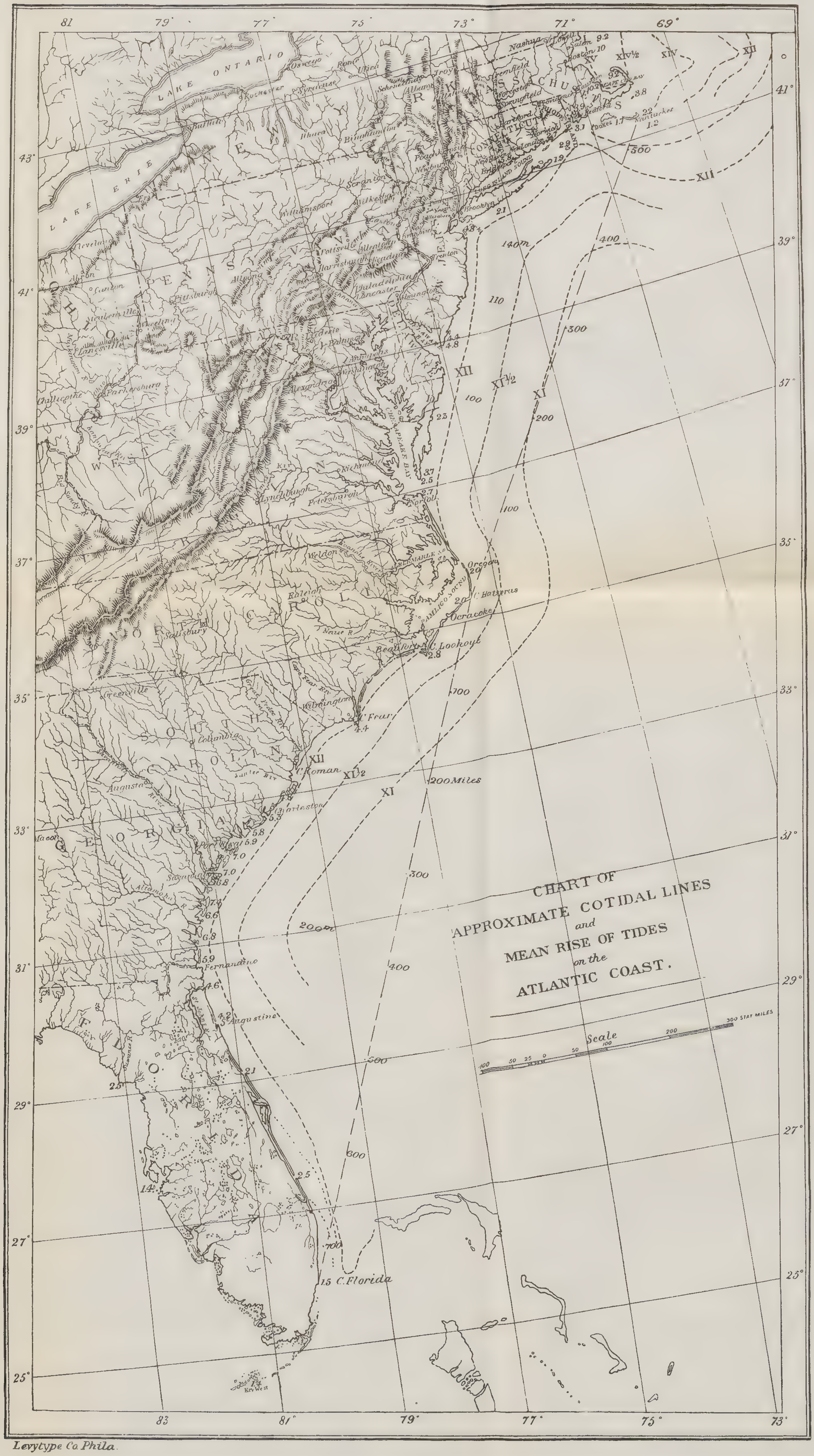


CHART OF
APPROXIMATE COTIDAL LINES
and
MEAN RISE OF TIDES
on the
ATLANTIC COAST.
Scale
300 STAT MILES
200
100
50
25
0
50
100
200
Levytype Co. Phila.

The Jetty System as at Present Applied.

In applying tidal scour to the improvement of harbor entrances in the United States, these three (3) principles have been laid down as fundamental:

1. The works should be so designed that "*they should not impede the inflow to such an extent as to prevent the tidal basin being filled at every influx of the tidal wave.*"

2. "*They should control the outflow to such a degree and in such a manner that a channel of the required depth will be maintained through the bar.*"

3. "*They should not to any considerable extent, cause a movement seaward of the main body of the bar; that is, the general position of the bar should be independent of the effects produced between and beyond the heads of the jetties.*"

The attempt to reconcile these conflicting conditions as to concentration of ebb and free admission of flood resulted, after mature consideration, in a plan involving low or submerged jetties, which were tried as an experiment both at Charleston and Galveston. The result has been to push the body of the bar seaward, without at the same time materially deepening the water on its crest. The cost of these experiments has reached nearly $3,000,000.

These plans are defective, not only in their failure to depress the plane of tidal scour over the bar, but they are so designed as to divert the ebb stream directly into the face of the flood, where the resistance to be overcome is the greatest. The plans for Galveston have been modified, and it is now proposed to raise the jetties to high water, at an estimated cost at this port alone of $7,000,000. But even if this be done upon the two

lines as proposed, there will still be the serious violation of the first of the above established principles, and the further serious objection of directing this diminished tidal prism into the face of the flood, near its point of maximum energy, with nothing to lower the plane of tidal scour except the small amount of head due to contraction. This is in violation of the accepted rule that all works designed for river or harbor improvements should aid, rather than oppose, nature. To turn an ebb stream out of its natural bed and deflect it by jetties across a bar is to impose additional resistance; first, from the change of direction, and second, from the additional resistance opposed by the higher crest and steeper slope of the bar. There is also a less effective relative area of ingress due to the form of the converging jetties.

Unless there is a large augmentation of the tidal prism by land drainage or from some other source during the epoch of the flood, such works will not, in general, prove beneficial. The location of the mouth of the jetties and the general design of the works is evidence that the principles enunciated in this paper as to the action of the flood and ebb forces have not been, as yet, fully appreciated in the planning of works of this description. The South Pass jetties are subjected to totally different conditions, as the flood tide furnishes but a very small percentage of the ebb discharge.

General Requirements for Harbor Improvements.

From what has already been presented as to the origin of the bars and the relations that exist between the flood and ebb resultants, it must be evident that the engineer who proposes to aid nature must so design his *external* works as to *prevent the flood tide from carrying sand into the channel* to obstruct

the ebb and require more work of it for its removal. He should also see that *the ebb be not diverted from its course, but be protected and defended* by a line of detached breakwaters. This will further have the effect of *confining the ebb waters*, which would otherwise escape in the swash or weir channels, to the main stream, *and so concentrate their energy upon a single point of the bar, and that point the one where the bar-building forces are the weakest.*

This barricade should *not in general be joined to the beach at the shore end*, but there should be left a wide opening across that portion of the bar which corresponds to the flood or beach channel. This should be deepened by the concentration of the flood currents, and the sand carried through the gorge would make fast land inside of the spit. Its quantity could be regulated by the extent of the opening. Thus the tendency of the flood to build its own barrier upon which to break would be aided, and the ebb would be protected in its escape. It also appears that but one such line of breakwater would in general be required, and hence the cost would be materially reduced. As it would occupy a site already dangerous to vessels, it would not increase the risks to navigation, but on the contrary, as it would project above the surface, it would be a beacon as well as a breakwater, and would greatly diminish the difficulties of effecting an entrance by sailing vessels over the case of a double line of extended jetties with a narrow pass between them, especially if submerged.

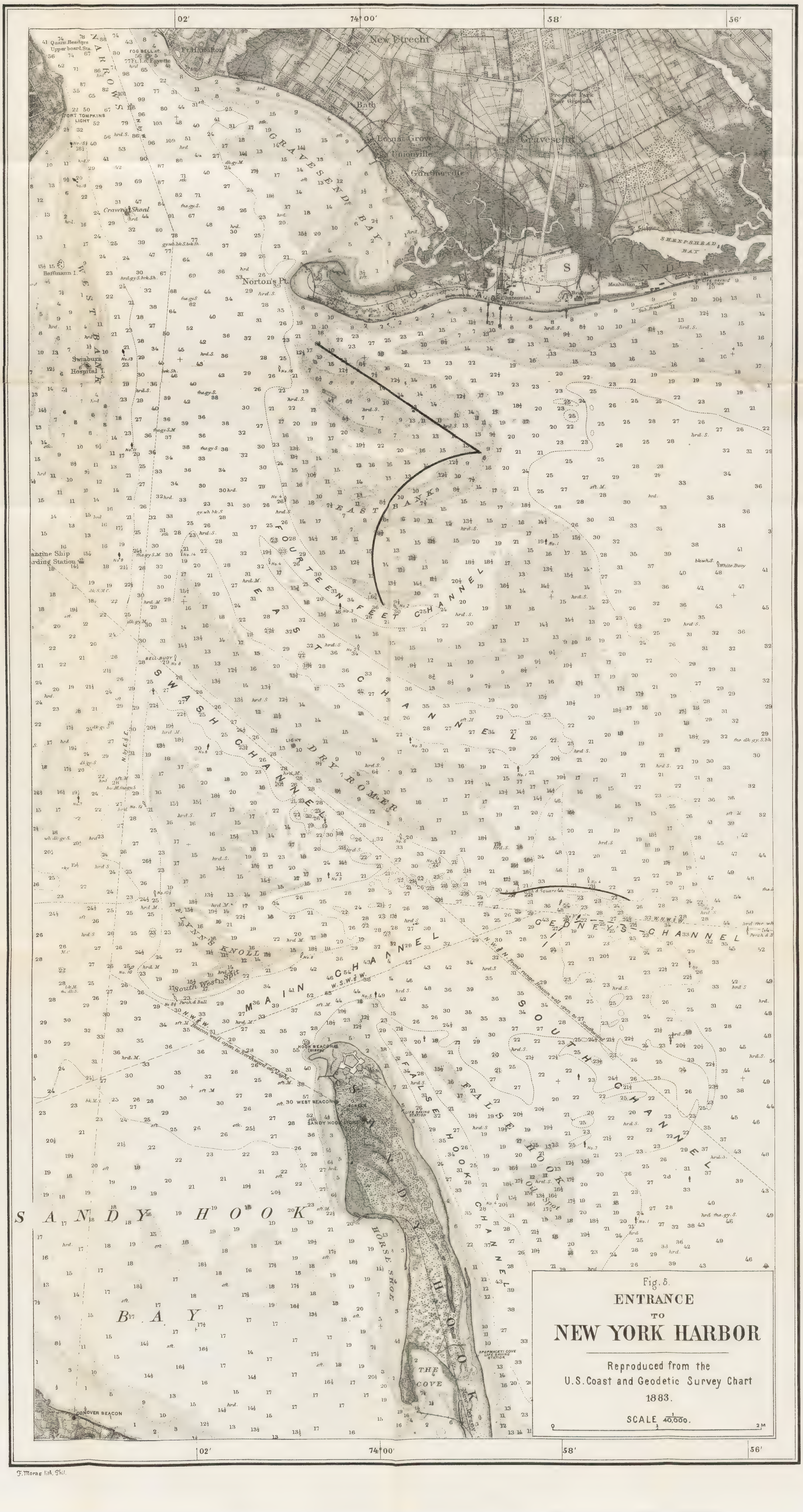
Internal Projects.

In connection with these external works there will be required in certain harbors regulating deflectors, or reaction dikes, to prevent the current interferences which produce hummocks, mounds, and even islands just inside the entrances

The position, extent and character of these works will depend largely upon the form and extent of the inner basin. Both the outer and inner lines should be so adjusted as not seriously to check the prevailing currents, nor produce shoals where they might be injurious to navigation.

The General Plan.

A typical plan for a breakwater which will not produce eddies or objectionable shoals, nor be eaten away by the sea, would be one composed of curves whose cusps are pointed in the direction of the advancing flood resultant, and having an inshore flank to concentrate the flood upon the beach channel, where it is both possible and desirable to maintain one. The curves should have the semi-conjugate diameters equal to about one-fourth ($\frac{1}{4}$) of the transverse. The interferences resulting from this *form* will produce shoals in front of the groins, thus reinforcing them, and as the outer end of the breakwater is pointed so as to receive the flood point blank, there will be no eddy nor any abrupt checking of its velocity inside to cause shoaling, yet the flood will be freely admitted and there will be a circulation created by having the beach end open. During the ebb there is no interference with the main current, but there is a concentration of its energy upon the weaker portion of the bar. For an illustration of this plan reference is made to the location on the chart of Charleston (Fig. 1), submitted herewith. The jetties, U. S. J. now under contract, cover a total length of six (6) miles. Those projected, of but three (3) miles, and the latter will make two (2) good channels, one for flood and one for ebb, while it is very doubtful whether the former will produce any material improvement of the entrance, but it will advance the general shore line and push the bar further to seaward.


74° 02′
74° 00′
58′
56′
New Utrecht
Bath
Dyker Heights
Bensonhurst
Gravesend
Coney Island
Manhattan Beach
Brighton
Sheepshead Bay
Fort Hamilton
Fort Lafayette
Fort Tompkins Light
Gravesend Bay
Gravesend Bay Channel
Craven's Shoal
Norton's Pt.
Hoffmann I.
Swinburn Hospital I.
Quarantine Ship
Quarantine Landing Station
Narrows
Swash Channel
Swash Channel Dry Romer
Four Fathom Bank
East Bank
Four Fathom Channel
Main Ship Channel
Main Channel
Lyman's Knoll
South West Spit
Sandy Hook
Sandy Hook Bay
Horse Shoe
The Cove
Hook Beacon
West Beacon
Sandy Hook Light
Conover Beacon
Fall Setter Channel
Hook Channel
Old Spot Channel
Gedney's Channel
Gedney's Channel Old Spot
Southern Channel
Swash Channel Middle Ground
Swash Channel Northeast by East
Main Channel Northwest by West
Main Channel West Southwest
Main Channel Northwest by West ½ West
Gedney's Channel Northwest by North
Gedney's Channel Northwest by West ½ West
Gedney's Channel Northwest by West
Gedney's Channel Northwest by North
Gedney's Channel Northwest by West ½ West
Main Channel Northwest by West
Main Channel Northwest by West ½ West
Main Channel West Southwest

The combination of this external barricade against the sand with the internal reaction dike for current concentration is shown in the chart of Galveston Harbor (Fig. 2), where the general direction of the movement is illustrated by the comparative shore lines and by the sand caught and held in the former channel by the south jetty. At the New York entrance (Fig. 5) similar effects are observed. Here the flood is compressed under the shore of Coney Island, where the beach channel is found, while the various ebb channels wind over the bar to the southward, increasing in depth as they approach Sandy Hook. The phenomenally deep basin on the bar at the head of Gedney's Channel is also seen. The plans as proposed for utilizing the existing natural forces for increasing the scour without obstructing any of the channels, are indicated by the heavy lines on the chart.

The Breakwater.

Jetties as now constructed are frequently composed of rip-rap stone of small dimensions, which lose nearly half of their weight when immersed. Hence they are easily displaced, and the work disintegrates. At Galveston the brush and stone jetties shrank or subsided during construction *61* per cent. The plans of the author propose to overcome this serious defect by constructing the breakwater of béton or other material constructed in barges, or on floats in the back channels, whereby the resistance of large masses will be rapidly secured to oppose the flood and protect the ebb. But the details of this method of construction do not properly constitute a part of this discovery. What is claimed as meritorious in this communication, and upon which the judgment of the Society is desired, is:

1. The determination of the character, direction and relative intensities of the forces acting upon any harbor entrance, from a study of the submerged topography and other local physical features.
2. The discovery of the existence of typical forms in the sandy spits bordering the entrance, which will in general indicate the direction of the resultant movement.
3. The recognition of the fact that the proper place for the ebb discharge, or channel over the bar, is as far removed as may be from the point of direct attack of the flood resultant, when the direction of the latter is not normal to the coast.
4. The definite enunciation of the principle that the trend of the coast with reference to the cotidal line will in general indicate at once the proper position for defensive works.
5. The presentation of an original form (in plan) of breakwater, whereby the natural agencies are materially *aided*, without serious interference with either the flood or ebb forces.
6. A method of improvement whereby the *internal* currents are concentrated and conserved for more efficient scour after passing the gorge.
7. A plan for utilizing the natural tendencies of the flood to cut a beach channel which shall be available for the lighter draught vessels.
8. The enunciation of the principle that the cause of the angular movement of the ebb stream after egress is due to the general form of the exterior coast line, which causes a racing of the tidal crests, from the outer capes towards the bight of the bay, and that the *flood components thus generated are the principal forces* which build the bars and shift the inlets. This incessant semi-diurnal action of the flood is *the controlling element* in the forces affecting

the magnitude and position of the bar. Storms and winds may modify and shift the deposits, but eventually the flood re-establishes the original conditions.

9. The free circulation and ingress given to the flood by the detached breakwater, so designed as both to oppose a portion of the flood and produce interfering waves which deposit sand outside of the channel whilst it also aids the ebb in its attack on the bar by defending its channel and concentrating its volume.
10. For a given site and stage of water the flood movement approaches in the *same direction*, hence the resisting and regulating works should be placed on the near side of the proposed channel. If on the far side, they would be worse than useless, unless for shore protection.
11. No artificial re-opening of an outlet which has been closed by this flood component, can be maintained without auxiliary works to deflect and modify its action. Dredging is only justified when the interests of navigation are sufficient to maintain a continuance of the expense and no other reasonable methods are available.
12. The ability resulting from these general principles to construct works requiring a lesser linear development which will produce greater navigable depths at less cost.
13. The abolition of the risks and difficulties attending the navigation of narrow jetty entrances in times of danger.
14. It frequently happens that the requirements of navigation and tidal concentration are conflicting, the former demanding wide entrances, the latter, on account of insufficient tidal volume, narrow ones. This debars the usual jetties and prevents improvement. The plans herein proposed are eminently adapted to meet such exigencies. As, for example, at Absecon Inlet.

Such being some of the practical results which it is claimed must follow from the discovery of the general direction and mode of action of the flood tide upon harbor inlets, an intelligent application of the principles should result in improving commercial intercourse, reducing the risks of navigation, lowering the rates of freight and insurance, and cheapening the cost of the construction of such works to the general government.

All of which is respectfully submitted for your consideration in compliance with a requirement of the By-Laws governing applications requiring an impartial but searching investigation.

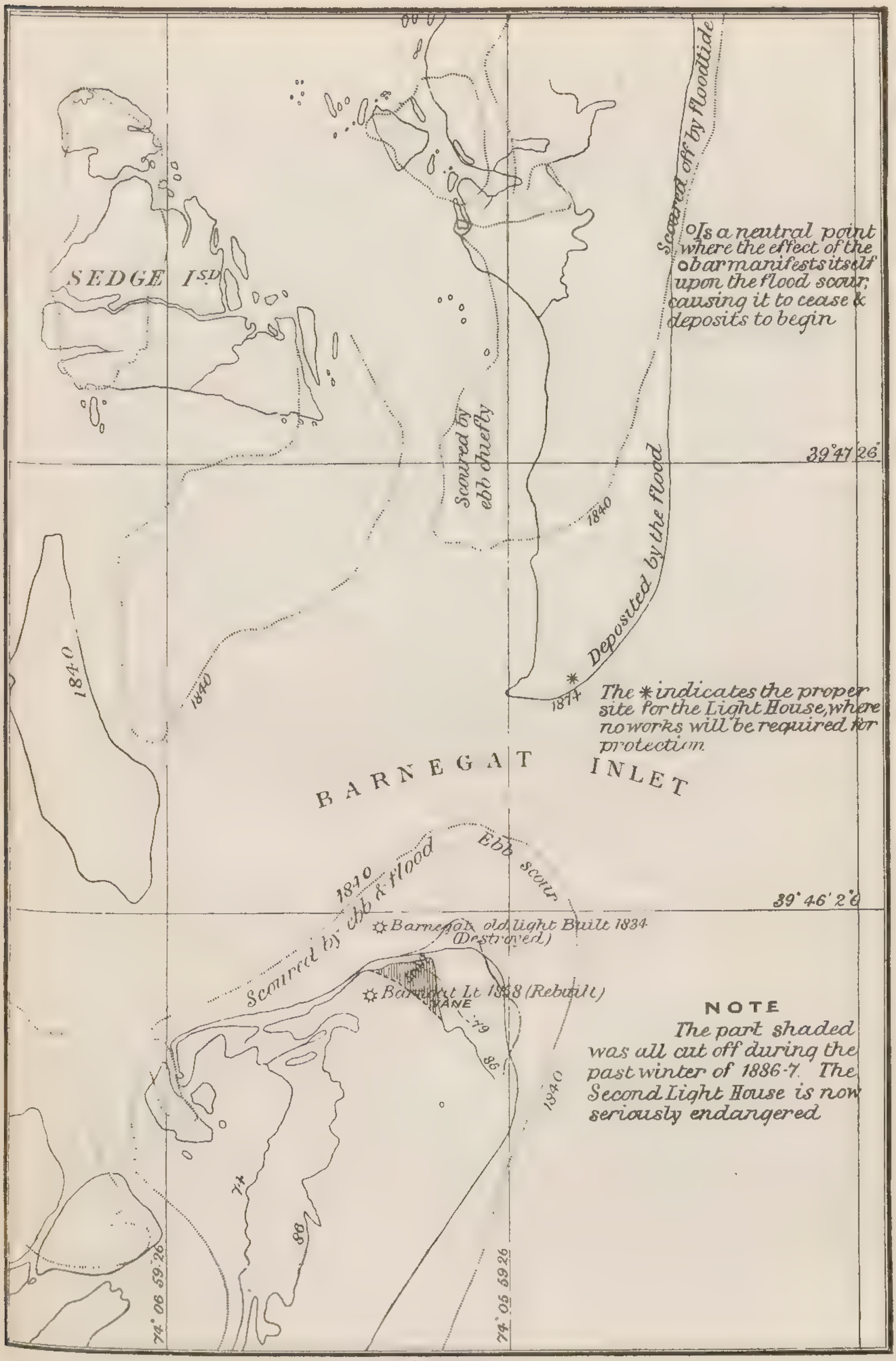
Supplement to the Paper on the Physical Phenomena, Etc.

Since writing the above paper, I have seen and made a copy of a comparative survey chart of Barnegat Inlet, which so fully sustains the theory of the cause and direction of the movement and shows so conclusively the practical value of such knowledge that it is submitted herewith as additional information. The notes on the tracing, excepting the date of the surveys, are my own. They will sufficiently explain the directions of the movements without further elaboration.

It appears from this chart, that the lighthouse erected in 1834 was destroyed by the encroachments of the sea, presumably just prior to the construction of its successor in 1858. This would give an average rate of scour on the *inner* beach of thirty (30) feet per year, due to the retarded flood and ebb currents at this point.

To protect the present structure, which was placed about eight hundred (800) feet to the south, three (3) or more jetties

PLATE IV.


SEDGE ISD
Scoured off by flood tide
Is a neutral point where the effect of the bar manifests itself upon the flood scour; causing it to cease & deposits to begin
39°47'26"
Scoured by ebb chiefly
1840
Deposited by the flood
1877
The * indicates the proper site for the Light House, where no works will be required for protection
1840
1840
BARNEGAT INLET
Ebb scour
1840
Scoured by ebb & flood
39°46'26"
Barnegat old Light Built 1834 (Destroyed)
Barnegat Lt 1858 (Rebuilt)
SHOAL
79
86
1940
74
86
74°06'59"26
74°05'59"26
NOTE
The part shaded was all cut off during the past winter of 1886-7. The Second Light House is now seriously endangered
Scale
FEET 5000 4000 3000 2000 1000 500 0
1 3/4 1/2 1/4 0
1 Statute mile

were constructed on the beach to deflect these currents. As the ends of these structures were nearly normal to the currents, they created eddies, were soon undermined and gradually swallowed up by the sea, so that at present but a short stub remains. Thus these auxiliary works prove but temporary and ineffectual. Money is continually being expended in futile attempts to oppose the onward march of the sea which declines either to be flanked or resisted by shore-protection works placed on the obstructing spit. By a change of base to the north spit, the interests of navigation would, doubtless, be as well subserved and all the defensive works be rendered unnecessary. The proper site is indicated on the tracing by a star.

The same conditions existed but a few years since at Absecon Inlet, and they are continually recurring wherever the lights are on the spit opposed to the flood resultant.

So far as permanency of location is concerned, it becomes a very simple matter therefore to select the proper site. The local interests of navigation may require it to be nearer the ebb channel. If, however, the flood or beach channel is improved by the form of breakwater proposed in this paper, the light may be placed on or just in rear of this structure, which from its *form* will not scour deep holes to undermine its flanks, as they do not cross the path of the flood or ebb normally, or even at a considerable angle, and thus the ability readily to locate a lighthouse where it will not be eroded, is another of the practical benefits resulting from this discovery.

PROC. AMER. PHILOS. SOC. XXV. 127. F. PRINTED FEB. 21, 1888.

The Albirupean Formation and its nearest relatives in Maryland.

By P. R. Uhler.

(*Read before the American Philosophical Society, January 6th, 1888.*)

Near the mouth of the Patapsco river, almost in the path of its ship channel, and at a distance of nearly one mile from the nearest shore of Rock creek, there projects above the surface of the water a huge pile of compact siliceous rock. This conspicuous body of sandstone has been an object of interest to mariners and tourists ever since the entrance to the harbor of Baltimore was first discovered. Almost from the first settlement of the region this island of stone has been called the "White Rocks." This name was given to it because of the white color which it presents when seen from the channel of the river in clear daylight; and the plural term, rocks, has reference to the several masses into which the island has been split by natural agencies. No accurate description of this remarkable object has yet been published, and as it is directly connected with one of the great geological features of Maryland, it deserves to be particularly noticed.

This white quartzite now forms fragments of the great sand-belt which crosses Chesapeake bay from the vicinity of Elkton in Cecil county, and runs in a south-west direction to beyond the great Patuxent river and grades into the low hills before reaching the East branch of the Potomac river. Eleven miles north-north-east of the city of Baltimore, it constitutes an extensive superficial bed, projecting two or three feet above the surface of the sandy loam, exposed over more than half an acre in extent. At this point it is broken into blocks and chunks, is largely composed of pebbly conglomerate (the pebbles often angular in form), and extends down fully ten feet into the sandy loam. South-east of this point for a distance of three miles or more, the same variety of rock has been reached at a depth of twenty to twenty-five feet in the excavations made for wells.

The next point where this quartzite may be seen is about eleven miles farther southeast. There much of the rock has an exceedingly dense texture. It lies in a broad sloping sheet dipping about ten degrees towards the east-south-east, and appears to be about twelve feet in thickness. This sheet of rock runs beneath tidewater at the mouth of Back river, and seems to cover nearly an acre in superficial extent.

About one mile farther to the west and up the Back river a continuation of this bed makes its appearance on the sloping shore.

The rock next appears in North Point creek about five miles farther southward, still maintaining the same compact texture. From this place, however, much of it has been removed, because of its obstruction to navigation.

Three miles distant, across the channel in the Patapsco river, we reach the island of stone alluded to at the beginning.

Here we see three oblong masses of sandstone rock, each more than thirty feet in length, separated by a few feet of water, the more superficial parts of which are a dense quartzite, rising like cliffs ten or twelve feet above high tide, and dipping from twenty to thirty degrees eastwardly. This is not the common dip of the undisturbed members of this series, and probably points to the exercise of tremendous energy in displacing a body of rock more than twenty-five feet thick, which at the bottom of the water, even now, covers more than a square acre in extent.

The two masses lying farthest to the north and east are more generally impregnated with ferric oxide, and being of looser, sandstone texture, suffer more loss of mass from the disintegrating effects of the water and atmosphere.

The most north-eastwardly cliff is exposed to the full force of the storms that beat in from Chesapeake bay, and the heavy ice cakes which are driven by the high winds of early spring plunge with terrific force against this side of the rock and dig out cavities near the water line. The most westwardly of these rocks has been cleft into two great pieces by a longitudinal division, and now lies slanting apart at an angle of about forty-five degrees. These pieces are composed in great part of dense siliceous layers, showing no grain, and weather on the upper surface into figures which resemble large fungi and foliated lichens.

Ferric oxide plays an important part in nearly all the members of this mass, but especially in the more granular and less dense portions. The iron solution stains the siliceous grains, eats into their figure, solders the particles into layers, centres around particular spots, enclosing them with a compact shell, and sometimes develops nodular bodies, such as may be observed in many parts of the sandy region east of Baltimore.

Proceeding from this island to the south-west shore of the Patapsco river we fail at first to find the white quartzite, but instead, there are long and wide stratified beds of brownish sandstone, which run back fifty feet or more in one exposure, and penetrate to an unknown distance into the sandy cliff on the northern shore of Stony creek. This is only a disguised form of our white sandstone which has been almost uniformly stained throughout by the ferric oxide. On the opposite shore directly at the mouth of this same creek there is a deposit of the overlying member of this sandstone series, which originally rested at a higher level than the sandstone beds on the opposite shore. By reason of the eroding energies of tide, frost and ice, this upper bed of coarse ferruginous sandstone has been undermined and thrown upon the bottom of what is now the mouth of the creek. This bed which now lies in water six to ten feet deep, is about twelve feet thick, over seventy feet in length, and perhaps sixteen feet in width.

It is a wonderful piece of structure from the curious way in which it has been altered into long hollow pipes, twisted slabs, and serpentine figures, brilliantly charged with the most intense metallic green, blue, red and yellow tints. How far it extends back into the adjoining country has

not been ascertained, but the unbroken end still sticks out of the adjoining cliff, at an elevation of about six feet above the surface of the water. Broken pieces of this rock lie along the shore in this vicinity extending for more than a mile in each direction from this creek.

On going back into the country, at a distance of five miles, the white sandstone again appears in immense deposits from six to twenty-five feet in thickness, and rests upon the sides or summits of such hills as have been eroded enough to cut down to the level of this stratum. The rock underlies the high hills which stretch across the more south-easterly part of this (Anne Arundel) county, and appears at various places over a low plateau or moderately rolling country, where the sand lies exceptionally deep. South-east of this belt high hills of the greensand Cretaceous form an obstructing barrier across the entire width of the county, and render it difficult of access.

In our Albirupean region, however, we rise gradually upon a moderately elevated plateau, which at its highest point midway between the head of the Severn river and Round bay, reaches scarcely more than eighty feet above the level of the tide.

The country sinks down in the direction of the Patapsco river, but rises as we go across the Magothy to the banks of the Severn and beyond towards the Patuxent.

The next large exposure of the white rock appears near the head of the Magothy river, where it is a massive variable quartzite and sandstone, the under-sides and ends of which disintegrate into sand. In many places only the denser and more compact parts remain as boulders or long masses connected with the sand, which still shows the form and stratification of the original rock; but which crumbles into a shapeless pile wherever it is disturbed. Some parts of the sandstone still retains cores of the hard rock, while the other parts extending to a distance of several rods farther on have undergone a sort of restratification and take on a more level bedding.

From the evidences abundantly present in almost every section of this region, it seems perfectly reasonable to infer that the immense body of sand spreading so widely and extending in such deep beds all over the belt, has been derived from the decay of this sandstone, in connection with the brown sandstone which overlies it, wherever the strata have not been too much disturbed.

After crossing the Severn river but few deposits of the white rock come to view. The sand continues on, but the rock lies deep in the ground, so that only in the wells, or in the deep ravines, do we reach the sandstone, and that is usually the upper and ferruginous member of this series.

However, when we reach the vicinity of the fork of the Great Patuxent river, in Prince George's county, the surface of the country is depressed and on a moderately level tract, almost surrounded by an amphitheatre of hills, the dense white quartzite once more makes its appearance. Here we observe a broken sheet of the rock, more than half a mile in length

by three hundred feet in width, and averaging about three feet in thickness, lying almost horizontal in the soil. At present somewhat more than two square acres of it are exposed to view in an almost continuous stratum. It rests here in a marshy meadow, surrounded by a mixed clayey sand, apparently upon the old flood-bed of the Patuxent river. At this point it is composed of bright, mostly compact silex, of great hardness, but with inconspicuous enclosures of kaolinic material, and closely resembles the common type of Potsdam sandstone. More than an acre of its former mass has been carried away to form abutments on the Baltimore and Potomac railroad.

Here it is more substantial than in the vicinity of the Severn, and seems to suffer but little loss from superficial disintegration. Much of its continuation towards the river has suffered from erosive agencies, and lies, in detached pieces, scattered through the woods. But in that part of the area, it is less densely compacted, and presents the appearance of a coarse-grained sandstone.

Beyond this point, in the direction of the Potomac river, no large exposures of the white rock appear, the Cretaceous sands and clays cover the formation, and it is only in a few of the deepest ravines that we meet with the coarse ferruginous sand-rock which belongs to a higher level in the series.

It yet remains to be seen whether this series of rocky strata is continuous with that which skirts the west shore of the Potomac from Mount Vernon southward to Acquia creek. Such examples of the stone as I have compared with the varieties from Maryland are of a different kind of texture. And, although there are various types of structure ranging all the way from a coarse conglomerate to a perfectly homogeneous quartzite, within our territory, those from Virginia are either composed of more crystalline separate grains, or are more decidedly mixed with drifts of coarse kaolinic matter.

On the Severn river we find excellent sections, giving nearly all the members of the series of strata composing the Albirupean formation. Directly on the river, it occupies a tract of country three and a-half miles wide; but it extends in thin deposits, at intervals between the hills on the northwest, back through a distance of at least ten miles more, thus giving it, in the widest part, a breadth of thirteen and a-half miles. The more rocky portions of this belt occupy now, however, a width of about three miles, and are far from being continuously connected, either along or across their line of strike. But they have not been always so restricted, for in nearly every part of the great sand area, decomposing pieces of the stone with the fresh sand derived therefrom may be found after a short examination of the surface.

On the eastern shore of Maryland, in Cecil county, the white sandstone appears on the surface in the form of huge boulders, six to ten or more feet in length, and from two to four feet in thickness. Considerable numbers of these large masses project above the surface at intervals on all the

sandy slopes of the lower grounds near the head of the peninsula bounded on the south by the Elk river. The same rock may also be traced in smaller boulders over the surface of the Cretaceous, the Eocene and Miocene to the vicinity of the Choptank river.

In Talbot county, from three to seven miles inland from Easton, it forms a zone of smaller pieces, as if a barrier of drift-loaded ice had stranded in a line across the country there, and melting had dropped these angular pieces in their present position.

The side of the neck of land adjoining the Elk river has been greatly scooped out by superficial agencies, and apparently a large proportion of the sandstone which originally formed the stratum here has been broken up and transported to a distance.

Some of the larger fragments observed on the surface in Talbot county have broad grooves cut diagonally across their surface, as if they had been pushed along under heavy weights which pressed them against sharp edged stones as they were moved over the surface. One piece in particular, four feet in length, nearly three feet in width and almost two feet thick, deserves to be mentioned here, on account of the singular appearance which it presents. It is a nearly flat slab of the very densest and hardest of the quartzite, very difficult to fracture, and resisting to the edge of well-tempered steel. But, notwithstanding its refractory nature, its upper surface composed of dense quartz is mostly polished, and has a series of three acute-ellipsoid excavations, each nearly three inches in length, more than a half inch in depth, and perhaps two-thirds of an inch in width across the middle. The sides of these holes slope towards the middle line and they are connected in a straight series by narrow grooves.

In addition to those, there are two diagonal channels, each about a twelfth of an inch in width cut along through a space of about six inches.

The piece of stone weighs upwards of six hundred pounds and is not like any that the Indians were accustomed to use in the preparation of their food. It was found lying in a field, at a long distance from any habitation, and does not possess any of the features which might accord with the architectural proclivities of any people thus far recognized.

In summing up we find the Albirupean to be a formation composed, as far as our present knowledge extends, of a lower bed of whitish clayey sand of variable thickness (often of five to twelve feet), followed next above by the white sandstone ranging from five to thirty feet in thickness; or where this is replaced by the pure white sand, being as much as ninety feet in thickness. This in turn is overlaid by thirty feet of black, drab,

red or white clay, which in turn grades into sandy clay and sand, from sixteen to thirty feet in thickness; this is overlaid by five to ten feet of ferruginous sand, carrying more or less pebbly, compact quartz, and this in turn is capped by the ferruginous sandstone ranging from two to twenty feet in thickness, over which, more or less, ferruginous sand, pebbles and gritty material, usually only a few feet thick, extends up to the soil of the surface. Accompanying this upper sandstone small and moderately large boulders of all the varieties of our adjacent Archæan rocks, but particularly of the flaky quartz, similar to that from the mica schists, occur, and sometimes form thick beds in the neighborhood of old river or brook channels.

So, by adding together the various members enumerated above, we reach an aggregate of more than two hundred feet for the full thickness of this formation, as we recognize it at the present time.

It rests below the green sand of the Cretaceous, which on the western shore of Maryland is piled up on a ferruginous sand-crust of its own; but the Albirupean has a much steeper average dip than the Cretaceous, and passes unconformably beneath it, as may be seen in the cliffs of the Severn river near Round bay.

The Albirupean dips eastwardly about ten to twelve degrees, while the dip of the Cretaceous scarcely exceeds five or six degrees.

It is nevertheless a fact that abrupt dips occur in all the alluvial formations of our tide-water region, but these appear to be due to the wavy inequalities of the underlying beds in places where material has been heaped up into hillocks by the arrest of rapid, loaded currents of water.

A similar kind of deposition of loose material takes place at the present time, on the bottom of Chesapeake bay and in the mouths of rivers like the Magothy, where "mud lumps," so-called, accumulate at the points where currents of water meet.

Thus far but few kinds of fossils have been discovered in the Albirupean belt, and these have rarely been found perfect enough for identification. Still, we have one species of Brachiopod, stems of Ecrinites and an Annelid-burrow in the white sandstone, and many unidentified vegetable forms in the dark clays which overlie the sandstone.

Such are a few of the features which characterize the Albirupean formation of the State of Maryland. But our sketch would be incomplete if it omitted to notice some of the peculiarities of the great clay-formation which lies beneath the Albirupean. Both together have been united in a common term as forming what has been called the Jurasso-Cretaceous. But whatever their geological position may be in correlation with the European formations, we are now accumulating information enough to show that they have points of difference from those which have been commonly admitted, and to render it necessary to symbolize them by distinct names. It is with this view that the term Albirupean is here proposed for the great sandrock system lying beneath the greensand Cretaceous, and the term Baltimorean for the conspicuous clay formation which

lies near the bottom of the alluvial column on the Archæan rocks of Maryland.

This Baltimorean formation may be recognized in the prominent hills and ridges of variegated red and white, and lead-colored clays which meet the eye near the roads leading along the inner limits of tide-water, between the head of Chesapeake bay, in Cecil county, and the Potomac river, in Washington.

In turning now to the Baltimorean formation, which is especially well-developed within the limits of that city, we see rather abrupt hills, rising eighty to one hundred feet above the adjacent level, composed chiefly of compact clays, alternating with beds of sand, some of which embrace slender drifts of quartz pebbles and fragments of kaolinic clay.

The formation is made up of numerous strata, constituting altogether a column of alluvial matter more than five hundred feet deep. That part which we can examine at or near the level of the lower streets in south Baltimore exhibits a dark lead-colored compact clay, well-stratified, and resting immediately upon a layer of dense iron clay-stone of only a few inches in thickness. Often the clay which comes in direct contact with this stone is stained a bright red color, is of a very fine texture, and is known as "puddling-clay." On this the distinctly stratified layers of dark clay, ranging usually from seven to nine feet in thickness, are built, and consist of strata varying from three inches to fully two feet in thickness. Between the finely ground layers, in contact with the smoothest surfaces, we meet with the remains of trees, shrubs, vines, ferns, equisetæ, and, perhaps, algæ. These fossil remains occur in the greatest profusion, accompanied by finely reduced lignite in the upper strata. At least five such intervening plant-beds are present in the base of Federal hill and its extension eastwards, in each of which some peculiar form of fern, vine, or leaf serves to distinguish it from the others. It has been my good fortune to discover these beds in this region, and to secure ample collections of all the remains at present found in them, and these are now being figured and described by Prof. Fontaine, of Virginia.

From the lowest layer I have taken out plants only of a low type of structure resembling algæ and nitellas; from the next layer above, equisetæ and ferns with strange vine-like structures; from the layer a few feet higher, buds and twigs of trees allied to the cypress and redwoods of California, as also leaves of ferns having the form of those of the Ginko; from the fourth layer other ferns, coniferous stems, buds and scales, with some leaves of dicotyledons resembling sassafras; and from the upper layer leaves which resemble those of the hawthorn, magnolia, willow, and hemlock. The less distinctly stratified clay overlying these is rich in lignite, often containing the trunks and limbs of nearly entire trees, some of which have been found with spruce-like cones and needle-shaped leaves.

The continuation of this bed upwards is composed of the iron-ore clays which form such conspicuous hills and ridges along the road leading to Washington. In this member of the series lie the extensive layers of

carbonate of iron, the richest of which occur near the bàse, while the nodules and oxidized lumps are found nearer the surface. The extension of this bed still higher, at various levels, displays the red and white variegated clays, such as we see in large areas in crossing the country south and east of the iron-ore hills.

The formation, as far as our present knowledge goes, and disregarding the iron-ore clays, first appears beyond the head of Northeast river on the eastern shore of Maryland, extending thence south of south-west—with an irregular expansion west—down the peninsula between the Northeast and Elk rivers, crossing the Chesapeake bay to Harford county, and proceeding across Baltimore county, the upper half of Anne Arundel and a narrower strip of Howard, Prince George's and Montgomery counties to the Potomac river. It is probably the lowest of the alluvial formations thus far discovered in Maryland resting on the outer, eastward, exposures of the Archæan rocks. Extensive faults in these rocks, besides the erosions, have left deep basins along a wavy line somewhat parallel to the western shores of Chesapeake bay, and in these depressions the beds of the Baltimorean formation have been laid down. At the bottom is found very micaceous sand containing an abundance of that type of compact quartz which belongs to the mica schists, and such as is seen in the Philadelphia micaceous gneiss.*

These micaceous sands form beds in many localities ten feet thick, but oftener much less than that, and they grade almost imperceptibly into obscurely stratified beds of white clay.

Next above this, the white clays alternate with sands in uneven beds, more or less stratified, the sandy members usually carrying drifts of quartz gravel in the lower portion. In some places the clay forms the chief element of these beds, while in others the sands prevail. The entire thickness of this part of the formation ranges from thirty to eighty feet, and is directly overlaid by whitish mixed sandy clay, upon which rests seven to nine feet of a coarse, angular sand, commonly pure white, capped by the thin layer of iron-paint-stone supporting the fossiliferous clay strata and iron-ore beds.

Above these latter the more or less ferruginous sands, mixed with drift of all sizes, form conspicuous beds of very variable thickness. In Clifton reservoir they constitute a series of strata and beds rising thirty feet above the dark or variegated clays, and are overlaid in turn by a few feet of quartz gravel, at or near the surface. Where the clay hills north of Baltimore have been denuded, these gravels are seen at the surface, but where they are undisturbed, the gravel lies from three to ten or more feet below the superficial sand or loam.

The region occupied by this formation is a rolling one, and towards the

* In passing it may be worth while to observe that this variety of gneiss has at one time formed extensive beds in contact with the more basic rocks on the north side of Baltimore, but these have been broken up, and now only their shattered remains rest on, or in, the soil as huge boulders or scattered fragments.

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north, north-east and north-west ascends by a series of sloping terraces, each grading seventy feet or more, to a level of about five hundred feet above tide. This is about the highest limit reached by the variegated clays and gravel which can be shown to belong to this formation. North of the city the Baltimorean extends back through the country to a distance of twelve miles, but it does not rise over the tops of the highest hills, and is often interrupted by the ridges of Archæan and other rocks.

Various changes have occurred to the clays of this formation of which a few examples may be cited.

Where cuttings have been made for streets on the north-east side of Baltimore, and at a point about two miles further east, the iron clays have been dislocated, presumably by floods of water, which have transported and dropped them in large lumps, often two or more feet in thickness. These are mixed in huge piles, and in two places have been thrust over the top of the ferruginous sandstone in such a way as to reverse the order of the series.

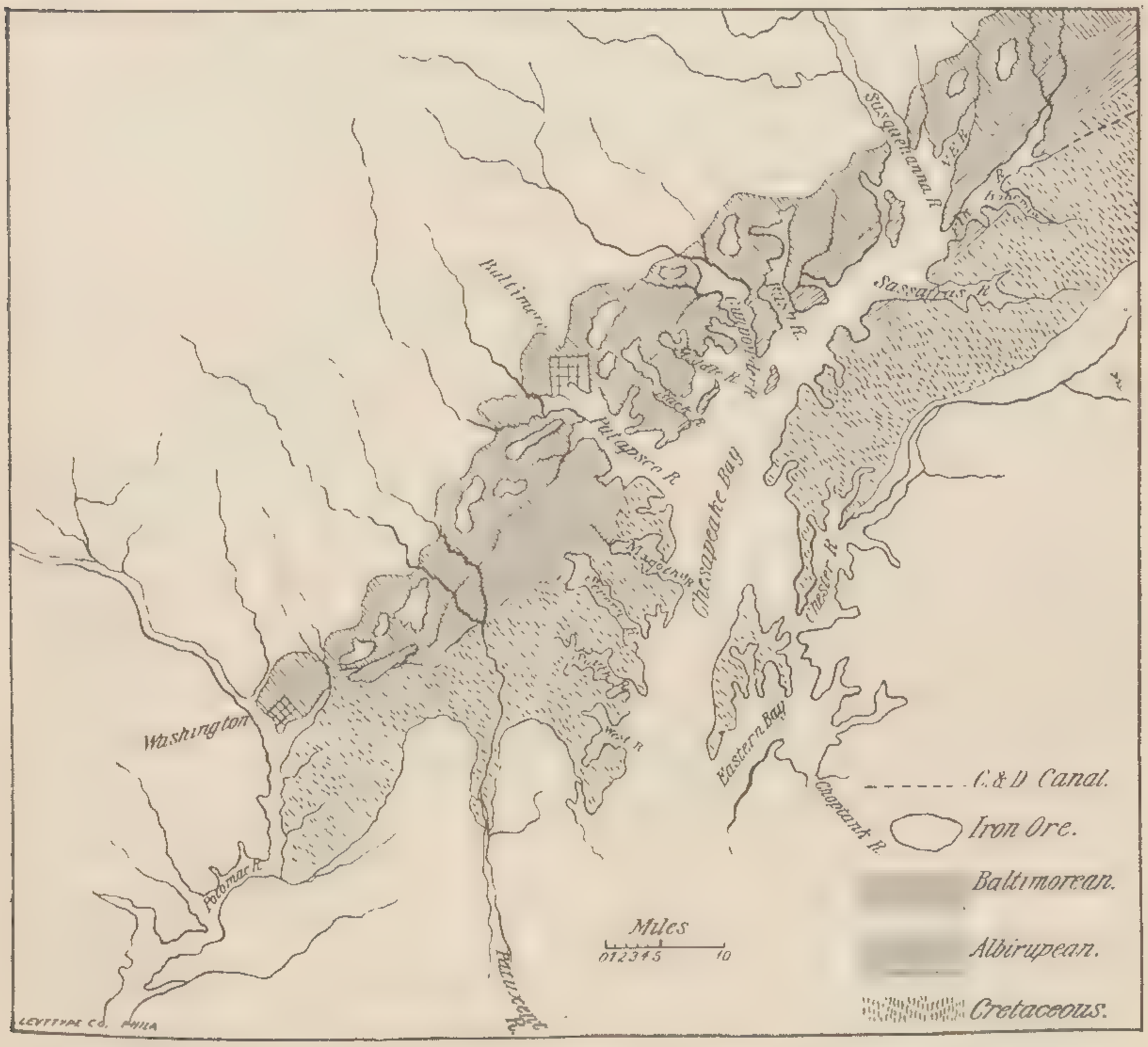
About one mile east of the city, the dark lead-colored clay forms a monumental pile which formerly rose more than eighty feet above the adjoining surface, but it has lost a part of one side by a fault that has produced a downthrow of about seven feet in depth. Another fault, in Federal hill near the end of Warren street, has pushed up the northern end fully seven feet above its proper level. The effects of this dislocation were evident in the broken condition of the beds for about one hundred feet in that direction, while towards the south and south-east there was no break or disturbance in the continuity of the strata.

The red and variegated clays which overlie the iron-bearing member are seen to lie in the hills along the Washington railroad at a much greater elevation than the mixed sandy loam and ferruginous sands which belong above them. This is owing to the fact that in many places the iron-ore series was deeply denuded before the newer beds were laid down ; and in some places there are evidences that the next later deposits have been torn off and transported to a distance.

The iron-ore masters insist that the iron-bearing clays rest in detached domes upon the underlying white sand, but this does not correspond with our observations as far as they have gone. We have traced them in a continuous series nearly all the way from the Gunpowder river to the Relay house, a distance of twenty miles, and again on the other side of Elk ridge to near Annapolis junction.

Beneath the city of Baltimore these clays bend down, but have been penetrated or passed through by all the deep wells of the region, and they are found to possess flexures, one of which carries them beneath the middle and eastern branches of the Patapsco river and brings them up on the opposite shores. In the southern continuation of Federal hill they dip down thirty feet in a distance of four blocks, about 1200 feet ; but they are discoverable at the bottom of the deep channel of the river and again form hills a mile beyond on the opposite shore. Nine miles south of

Baltimore these strata dip below the surface of tide, pass under the Albirupean at an angle of about twenty degrees and entirely disappear from view.



Reviewing the three alluvial formations which are passed over between the city of Baltimore and Chesapeake bay, we find that each is overlaid by a system of drift, that of the Baltimorean carrying angular erratics, mixed with compact quartz pebbles, all derived from the Archæan rocks of the neighborhood, with the exception only of boulders of Potsdam sandstone probably dropped by floating ice. In the upper part of this mixed gravel, and commonly above it, rests the stratum of ferruginous conglomerate so conspicuous wherever this member of the series occurs.

It is possible that this is the position in the series to which should be referred the thick beds of gravel and quartz drift that now chiefly lie exposed at or next the tops of some of the low hills north of Baltimore.

Near the summit of the Albirupean, we observe loose strata of gravel and quartz-drift, capped by a crust of ferruginous sandrock composed of unusually coarse grains of quartz. This belt of rock is exceedingly thick in some places, as on the Severn river below Indian landing, where it

reaches a thickness of at least twelve feet. The drift in this stratum is chiefly gravel, with small rounded pieces of the compact quartz, and the pebbles usually enter into the composition of the upper part of the brown sand-rock, making it more or less of a pudding stone.

As the point near Round Bay is approached where this formation passes beneath the greensand Cretaceous, the brown sand-rock divides into two members, the upper one of which is only about a foot in thickness, while the lower one has a thickness of more than five feet. No large angular blocks were found in this part of the formation ; but on Valentine's creek it is closely packed with round quartz boulders, such as are made in pot-holes, or in glacial rapids.

Near the top of the greensand Cretaceous a slender drift of small quartz boulders and pebbles occurs, and over this rests a sinuous, flaky crust of finer, powdery ferruginous sandstone, the oblong chambers of which are closely packed with micaceous grayish sand full of glauconite.

The Baltimorean formation seems to have been produced in a region adjoining the sea where accumulations of sand and aluminous mud were ground out of the broken members of the Archæan rocks. Several large rivers brought down their quota of this material, spread it out at their mouths, and piled it up to be farther distributed by the waves and storms of the ocean. Vast accumulations of clay marked the later part of the period during which land-locked bodies of fresh water were connected by narrow channels with the estuaries next the ocean.

On the shores and in the waters of these muddy gulfs and lakes probably lived the Jurassic Dinosaurus, the Pleurocœlus nanus, Pleurocerus altus, Allosaurus medius and the Cœlurus gracilis, whose remains have recently been described from the clays of Prince George's county by Prof. Marsh. To these we may add the Astrodon Johnstonii of Dr. Leidy, and the crocodiles and turtles whose bones have been taken from other parts of the same beds.

On the land flourished a richly varied and abundant vegetation, with forests, fern brakes, and trailing vines, while in the rivulets fresh-water plants spread over the bottom of shallow channels.

Following this came the Albirupean, a more decidedly marine formation, in which sands form the chief element of deposition, and which, later, became a distinctly sandstone-forming epoch. Layers of siliceous plastic mud were spread out over the indurated sands and bound them together in heavy belts of stone. Steady deposition, in wide irregular basins, gradually increased the sedimentary beds and quiet periods allowed the development of aquatic animals. Accordingly in the sandstones of this area we find the burrows of worms, the stems of encrinites, the cells of corals and the shells of brachiopods. On the land an ample vegetation must have existed, since between the layers of an upper bed of clay the densely packed lignitic remains of coniferous trees and the fragments of twigs, buds, leaves and seeds of several kinds of plants are found in abundance. On the south-eastern border of this zone of sand and sand-

stone, the greensand Cretaceous rests piled up in high abrupt hills on the western shore of Chesapeake bay, crossing the country with an unevenly defined breadth of about ten miles. On the Severn river, across the southern part of Round Bay, high domes of these clays and loamy sand form monumental hills, as for example Mount Misery; while between this river and the head of South river almost equally prominent hills arrest the attention of the observer. Crossing the great Patuxent the Cretaceous hills again come into view and finally form high and bold prominences near the Potomac river.

On the eastern shore of the Chesapeake, however, the Cretaceous hills do not form the bold prominences that have been noticed above, but instead, rise into gentler eminences, sloping towards the water courses in moderate rolls, and finding their greatest development along the low ridge which separates the rivers of the Chesapeake from those of the Delaware.

In this formation we have a repetition of the marine conditions of the preceding, but with the added element of the greensand, which now for the first time makes its appearance.

The black loamy beds of this formation are packed with the lignitic remains of trees and plants, while the lower lying greensand, and especially the upper greensand marl beds, are crowded with the casts and shells of many kinds of mollusks.

From what is here recorded it will be perceived that in the State of Maryland there are three well-defined sedimentary formations resting below the Tertiaries, and that the first and last are formed of bold reliefs, while the intervening one is comparatively low and flat.

In reply to the above Professor Carvill Lewis remarked:

That having spent several months in Baltimore and having had some opportunities of studying the geology of that district, in which he had the kind assistance of his friend Professor Uhler, he took the liberty of suggesting certain objections to the conclusions of the foregoing paper and to the adoption of the new term "Albirupean."

A series of three formations, belonging to the "alluvial column," is here described, of which the lowest (the "Baltimorean") is a series of variegated clays and sands, some of which have yielded a fauna and flora indicating a Jurassic or Cretaceous age. These have long been known and are marked on Tyson's Geological Map as the "iron-ore clays" and appear to be the formation already named the "Potomac." Upon these clays Professor Uhler places his so-called "Albirupean," consisting sometimes of sands and clays, sometimes of a massive sandstone or quartzite, containing brachiopods, encrinite stems and annelid burrows; while the uppermost of the "three alluvial formations" consists of Cretaceous greensand. This latter is also well known, having been described by Ducatel in 1834.

As to the "Albirupean formation," the speaker held that Professor

Uhler had here confounded under one name two entirely distinct formations of very widely separated ages. The specimen of "Albirupean" exhibited this evening contains fossils (a brachiopod and encrinite stems) characteristic of a Palæozoic and not a Mesozoic formation, and the petrological character of the rock is also that of an ancient sandstone, resembling the Medina or Potsdam sandstones. The fossils point to the lower Silurian age or thereabouts of the sandstone, and it is probably of nearly related age to the metamorphic limestones which occur in the vicinity of Baltimore. It is of course incredible that a rock of Palæozoic age could overlie the "Baltimorean" clays, and Professor Uhler has given no facts or sections to prove that such is the case.

The mistake has probably arisen in confounding the weathered portions of the sandstone with the sands and clays of Mesozoic or more recent age which occasionally overlie the variegated, iron-bearing clays. As a result of decomposition, the ancient sandstone frequently becomes loose and sandy, and is marked with ferruginous streaks so as to closely resemble the much more recent sands and clays of the neighborhood. An example of this kind may be seen a few miles north of Baltimore. The mistake of confounding the two formations would therefore be a very natural one, especially as the younger formation is in large part made out of the older one, and as outcrops in the region are scarce. Geologists cannot be expected to accept the term "Albirupean;" for even if limited on the one hand to the sandbeds of Mesozoic age, or on the other to the patches of Palæozoic quartzite, it is, to say the least, unnecessary, while if applied to both formations it would be a source of confusion.

Professor Heilprin stated that:

From the data and material presented by Dr. Uhler, he was disposed to agree with Professor Lewis that two or more very distinct formations were included in Uhler's "alluvial column," and that one of these (forming part of the so-called "Albirupean" series) was almost unquestionably Palæozoic. At least, this position was indicated by the brachiopod and crinoid impressions which are seen on some of the rock fragments exhibited before the Society. Neither of these impressions is very distinct, but such relationship as they indicate is more nearly with Palæozoic than with Mesozoic forms. Referring to the formations characterized by Dr. Uhler as "Baltimorean" and "Albirupean," and the "Potomac" of the United States Geologists—the last supposed to be in part synchronous with the preceding—and to the determination of their age as Jurassic, Jurasso-Cretaceous, and Lower Cretaceous (Wealden), Professor Heilprin stated that he failed to find any satisfactory evidence proving the strata characterized to be older than Upper Cretaceous, and that in all probability they are the absolute representatives or equivalents of a portion of the well-known New Jersey series—the colored clays and sands abutting upon the Delaware river.

Epitaph of M. Verrius Flaccus. By Rev. C. W. King, M.A.

(*Read before the American Philosophical Society, December 16, 1887.*)

The collection of antiquities of Count D'Hérisson, the result of long-continued excavations in Apulia and around Carthage, comprised a marble slab, described in the sale catalogue as "The Epitaph of M. Verrio and his brother, Celsus, with two skulls and an axe." But the Count could boast of resembling the "Divine Williams" (as he would call him) in one point at least—that "he had small Latin," for the merest novice in that language could easily read the inscription as: "To Marcus Verrius Flaccus, son of Marcus, of the Tribe Falerina, his brother Celsus [erected this]." I subjoin a *fac-simile* of the epitaph, showing the arrangement and relative proportions of the lettering.

M. VERRIO

M. F. FAL. FLACCO

CELSVS . FRATER.

The inscription is cut in the round, bold character used in the later days of the Republic, and which did not outlast the first century of the Empire. The material is a slab (2 ft. 4 in. by 1 ft. 6 in.) of the marble of Paros, the quarries of Luni (Carrara) were but recently opened when Pliny wrote. The back of the slab has been left very uneven and rough, for the purpose of taking better hold upon the bedding of mortar by which it was inserted in the façade of the tomb, no doubt a brick construction. The once-polished surface is much weathered, giving evidence of the many centuries for which it had retained its original position (and, probably, had witnessed the fall of that Empire with whose birth it was nearly coëval) before it was buried in the earth along with the ruins of the monument. About a third of the surface shows more corrosion than the rest, in consequence of having been covered to this extent by the mortar and the rubbish.

Before attempting to identify the individual thus commemorated, I shall remark that the *Verria* was a plebeian family, and the *Falerina*, in which it was registered, a rustic tribe. "Flaccus" was the actual name of the deceased; for the "Nomen" and "Tribus" of the *Verrius* had been, according to rule, assumed by his father, originally a slave, on becoming a freedman of that family. That "Flaccus" was a word of some *Italic* dialect, perhaps Oscan, in which similar forms occur, as "Maccus," etc., and that, with "Bassus," "Varus," and the like, it denoted some personal peculiarity in the first who bore it, cannot reasonably be doubted, and it may have been synonymous with *pen-*

dulus, in the sense of "lop-eared," * as its derivative *flaccidus* is applied to anything that droops. So far, the marble is of little importance in itself, except as a fine specimen of early Roman epigraphy; but fortunately, this is one of those very uncommon cases, where the name and fame of the deceased are embalmed in history, a circumstance that gives a far higher value to any memorial of the man.

We learn from Suetonius that M. Verrius Flaccus was the son of a freedman (*libertinus*) as was the father of his contemporary and namesake, Horace. He possessed a remarkable talent for teaching; his plan was (apparently an invention of his own) to give his pupils subjects for declamations in which they should compete with each other for the prize, which was a book, valuable either for its *antiquity* or its beauty. The novelty of his system of education appears to have consisted in this. Induced by his high reputation, Augustus appointed him Præceptor to his grandsons, Caius and Lucius; with a salary of one hundred *sestertia* (£1000) a year. He furthermore lodged him with his whole class (of twenty boys) in the palace, making, however, the stipulation that he was not to increase the number of his pupils. Flaccus compiled a Table of Fasti, which was engraved on marble slabs in the *hemicyclium* (alcove) at Præneste, where his statue was standing when Suetonius wrote. He died at an advanced age, under Tiberius.

Ovid refers (Fast. vi, 58) to this work of our Flaccus, where he makes Juno say:

> "Inspice quos habeat nemoralis Aricia fastos
> Et populus Laurens Lanuviumque nemus:
> Est illis mensis Junonius: inspice Tibur;
> Et Prænestinæ *mœnia sacra* Deæ."

According to this, the Tables of Fasti were built into the walls of the celebrated Temple of Fortune, the special Deity of Præneste. This explanation has been confirmed by a fortunate discovery. In the year 1770, Foggini, a Roman antiquary, excavated the ancient Forum of Præneste, and came upon the ruins of a circular [semi-circular ?] building, from amongst which he recovered the tablets containing the Kalendar for the months January, March, April, and September, in a perfect state, together with numerous fragments of the others. †

Our Verrius appears to have been held of high authority in matters of antiquity, for Pliny quotes him no fewer than seven times, and always upon curious subjects, as the following will show: "That the Romans upon laying siege to a town, began by evoking the presiding deities of the place (*in quorum Tutela*) by promising them equal or greater honors at

* The *cognomen* "Flaccus" is probably an Oscan word, denoting a personal peculiarity, and signifying "lop-eared."

† Prof. Nettleship, of Oxford, has skillfully reconstructed the plan of Verrius' great work, "De Verborum Significatione," in the American Philological Review, Vol. i, p. 253–70, and ii, p. 1–19.

Rome. A form of evocation was still preserved in the Pontifical Books, and the true name of the guardian of Rome was kept a secret (like the *Shem Hamephorash* of the Jews) for fear some enemy might use it for the same purpose."

"That *Vermilion* was in such estimation with the ancients, that the face of Jupiter Capitolinus was painted therewith on the great festivals; also the faces of generals while they rode in triumph, citing Camillus as an example."

"That Tarquinius Priscus wore a state tunic woven out of gold wire (as was that of Virgil's Lausus)—

Molli mater quam neverat auro.—*Æn.* x, 818.

and like that worn by Agrippina at the opening of the tunnel draining Lake Fucinus."

"That lampreys have *thin*, eels *thick* skins, which were by the ancient laws used for flogging *pueros prætextatos, i. e.*, boys under age, because they were not liable to pecuniary fines; according to the rule that 'he who cannot pay in purse must pay in person.'" Verrius had, furthermore, recorded many instances of *sudden* deaths (which Pliny considers the height of felicity) from joy and similar causes. "That the Romans, for the first three centuries, were not acquainted with *wheat*, but lived upon *spelt* in the shape of porridge (*farre e frumento*)." It is true, that the earliest coins of Metapontum attest that bearded wheat, *triticum*, was the staple in Southern Italy at a period ranging from 700 to 400 B. C.; but the Romans had no intercourse with those parts before the war with Pyrrhus. *Spelt* is the primitive form of the cereal just emerging from the state of a grass-seed; the grains are smooth and very thinly arranged in a long ear. Varro, also, gives the actual date when bakers first came to Rome from Greece, before which time, the inhabitants used the grain only as porridge, *puls*, exactly as the Red Men of our day eat their maize in the shape of *hominy*. Similarly, this simple preparation of grain constituted the national food of the Celts when they had ceased to live entirely upon the flesh and milk of their cattle, for the ill-tempered Jerome, squabbling with the Irishman, Celestinus, despatches him with the sarcasm:

"Hoc non videt Celestinus,
Celtarum *pultibus* prægravatus."

And Ammianus mentions that Julian, in the disastrous retreat from Persia, eat nothing but "parum pultis etiam gregario militi *fastidiendum*," and we must remember that the main strength of the Roman army lay in the Gauls and Germans who had followed the Emperor from the West.

"That the Romans once (the date is not specified) exhibited fighting elephants in the circus; and afterwards, killed them with darts because they knew not what to do with them; not being willing to bear the expense of keeping such huge beasts; or to make presents of them to foreign princes."

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These casual extracts sufficiently indicate that had the "Antiquities of Verrius" come down to us, it would have proved as valuable a mine of information for Roman as the "Deipnosophists" of Athenæus is for Grecian archæology.

The *prænomen* borne by Flaccus is not recorded by Suetonius, but Jerome, in his Chronicle, gives it as "Marcus," and puts down the grammarian as flourishing (*floruit*) at the same time with the philosopher Athenodorus of Tarsus. The agreement, therefore, of our inscription with Jerome in this important particular, is strong evidence that both of them are to be referred to the same person, whose date, again, is all but precisely fixed by the archæological proofs deducible from the monument itself.

A "T. Verrius" is one of the Decemviri of Saragossa who coined brass pieces in the name of Augustus in the eleventh year of his reign. Can this man have been the *father* of our grammarian? Certainly the name of his colleague, "C. Alliarius," has so plebeian a sound that we can hardly think it beneath his dignity to have been joined in office with a manumitted slave.

Two skulls, an axe, and an iron bangle, came to London with the monument as having been discovered in the same tomb. These human relics are very remarkable in themselves. The one is that of a man so advanced in life that the *sutures* are entirely obliterated, yet the teeth are sound, though much worn down on one side, as if the owner for some cause had chewed on *that* in preference to the other. The form is unusually elongated, the forehead low but very broad, indicating considerable mental power.

The other skull is the head of a young man, finely-shaped, with teeth of the most exquisite regularity and enamel. As even an Italian *antiquario* could hardly attempt to pass them off (like the celebrated *duplicates* of Cromwell) as those of the *same* man in youth and age, or we may suspect that the mistranslation of the epitaph, as given in the Sale-catalogue, suggested the *discovery* of the remains of the *two* brothers. We must attribute them (if really found in company with the marble) to long subsequent interments in its vicinity. But the question of ownership in the matter of these relics of humanity is, to me, settled by another consideration. It was as impossible for the corpse of Augustus' schoolmaster to have been laid entire in the earth, as it was, but a few years back, for that of an Englishman of the same *status* in his profession, to have been "cremated." That these *crania* should be given to some of the barbarous races, who, long after the times of Verrius, so frequently overran Apulia, may reasonably be conjectured from the articles deposited with them. The *axe*, though greatly corroded, preserves the exact form of the missile *francisca*, the so much dreaded weapon that got its name from the Franks. And the *bangle*, a flat bar one inch in width, meant to be permanently fixed upon the wearer's wrist by the hammering-up of the two ends till they overlap, is an ornament used only by savages. Add to which, the sound condition

of the teeth of the elder defunct at so advanced an age, is a sure proof that he had never enjoyed "the blessings of civilization." (These *crania* are now deposited in the Museum of the College of Surgeons.)

It is so rare to meet with the actual memorials of personages named, ever so incidentally in Roman history, that have escaped "The Goth, the Christian, Time, War, Flood, and Fire," that this marble may justly be reckoned amongst the most interesting relics of antiquity that have come down to our times. As the monument of a great scholar, who enjoyed so high a reputation in the brightest days of literature, no more fitting shrine for its preservation could have been found than the library of Trinity College, where the *Manes* of the ancient Professor will, after so many centuries of oblivion, hear his name and fame once more echoed by thousands of voices—and be (let us hope) propitious to the depositor who has thus carried out the last desire of the tormented ghost:

"Rinfresca la memoria mia che giace."

Obituary Notice of Ferdinand Vandevere Hayden, M.D., Ph.D., LL.D.

By Prof. J. P. Lesley.

(*Read before the American Philosophical Society, January 20, 1888.*)

Dr. Hayden was born in Westfield, Mass., September 7, 1829; was graduated from Oberlin College, Ohio, in 1850; and received a diploma from the Albany Medical College in 1853. Under the orders of Prof. James Hall of Albany, he went with Mr. F. B. Meek to collect Cretaceous and Tertiary fossils in the White River Bad Lands. In 1854–5 he explored the upper Missouri river region, mainly at his own expense, aided by the American Fur Company; following the Missouri river to Fort Benton, and the Yellowstone to the mouth of the Big Horn. His collections of fossils were sent partly to the Academy of Natural Sciences in St. Louis, and partly to the Academy of Natural Sciences in Philadelphia. In 1856 he made a summary report of the whole region which he had explored to Lieutenant Warren, U.S.T.E., and immediately began a general reconnaisance of the North-west as geologist on Warren's staff. This survey extended to 1859. The next three years, to 1862, he explored the Yellowstone and Missouri rivers as naturalist and surgeon to Captain Raynolds' expedition. The Civil War having broken out, Dr. Hayden, in May, 1862, was appointed Acting Assistant Surgeon of Volunteers and placed in charge, first of Satterlee Hospital in Philadelphia, and then (February, 1863, as full Surgeon of Volunteers) of Beaufort, South Carolina. February,

1864, he became chief medical officer of the army in the Shenandoah valley, at Winchester, Va. May, 1865, he was breveted Lieutenant Colonel, and resigned his medical duties for work at the Smithsonian Institution.

In 1865 he was elected Professor of Geology and Mineralogy in the University of Pennsylvania, resigning his chair in 1872 on account of his western explorations; for, in 1866 he explored a second time the Bad Lands of Dakota, collecting largely vertebrate fossils for the Academy of Natural Sciences of Philadelphia. From 1867 to 1879, twelve years, he was United States Geologist in charge of the survey of the Territories. From 1879 to 1883 he was employed as Assistant Geologist of the United States Geological Survey in preparing for publication his surveys in the Territories. Relieved of this literary work in the Spring of 1883, he did field work in Montana until he resigned his position, in the Autumn of 1886, his health having become so impaired that he was confined for the most of the time to his bed. He died December 22, 1887.

Dr. Hayden never practiced medicine, but used his medical knowledge in the superintendence of the army hospitals. He received the title of LL.D. from the University of Rochester in 1876, and again from the University of Pennsylvania in 1886. He was elected a member of the National Academy of Sciences in March, 1856; of the American Philosophical Society in July, 1860; and of many other societies in America and in Europe.

His fame as a geologist in Europe was extraordinary. It is not too much to say that his name was more familiar to the geological world in Europe than that of any other American geologist. This was evident to those of his collaborators in the science who visited the foreign cities, or were in correspondence with foreign geologists. It was due to the exceptional number of his geological contributions, to the freshness of the fields which he explored, and to the untiring energy with which he published his observations as fast as they were made, and communicated them, in large editions, to all the working geologists abroad. The amount of Hayden literature (as it may be justly called) in every library of the world is surprisingly great. More than fifty octavo volumes, copiously illustrated with pictures, sections, topographical and colored maps, were published by him, to make known his territorial surveys from 1867 to 1879. His report on the Warren survey was published by the War Department; and in papers read before the Academy of Natural Sciences of Philadelphia, in 1857 and 1858, and in the Transactions of the American Philosophical Society of Philadelphia, in 1862, describing not only the geology, but the living vertebrates, reptiles, fresh-water fish and shells of the region. Another paper in the Transactions of our Society (of the same date) made contributions to the ethnography and philology of the Indian tribes of the Missouri river. The same year he published a sketch of the Mandan language in the *American Journal of Science;* and in 1869 notes on the Pawnee, Winnebago and Omaha languages in the Transactions of our Society. His second survey of the Bad Lands produced a memoir for the Academy of Natural Sciences of Philadelphia, in 1869.

Dr. Hayden will be remembered as one of the great discoverers of the world in the history of the science of geology. He will be recognized as a man who really opened a new world in the far West to intelligent curiosity and detailed exploration. His influence in educating the western population of the United States was as great as that of Agassiz, in inspiring the population of the eastern States with an enthusiastic admiration for natural history. The two men cannot be compared; for their personalities, their scientific objects, and their methods of research were in strong contrast. Each was an acknowledged leader in his special realm. There was the same indescribable power exercised over a great number of minds. Whatever Agassiz asked for in New England was immediately granted, and with enthusiasm. Whatever Hayden asked for from the people, the politicians, and the Governors of the new States and Territories was allowed to be useful and desirable, and the means placed at his disposal. He represented in science the curiosity, the intelligence, the energy, the practical business talent of the western people. In a few years they came to adopt him as their favorite son of science. He exactly met the wants of the Great West. There was a vehemence and a sort of wildness in his nature as a man which won him success, coöperation, and enthusiastic reputation among all classes, high and low, wherever he went. In the wigwam, in the cabin and in the court-house he was equally at home, and entirely one with the people. He popularized geology on the grandest scale in the new States and Territories. He easily and naturally affiliated with every kind of explorer; acting with such friendliness and manly justice towards those whom he employed as his co-workers that they pursued with hearty zeal the development of his plans.

In dealing with the public men of the country he was so frank, forcible and direct that it was impossible to suppress or resist him. He had the western people at his back so heartily and unanimously that he was for a long time master of the scientific situation at Washington. He was a warm personal friend of some of the highest officials of the Government, who never failed to support strenuously and successfully his surveys. I think that no one who knows the history of geology in the United States can fail to recognize the fact that the present magnificent United States Geological Survey, now under the direction of Major Powell, is the legitimate child of Dr. Hayden's territorial surveys.

Dr. Hayden first conceived the idea of setting aside for national use, as a perpetual park, the region of the Yellowstone geysers. This idea he urged with such success upon Congress, that a law prepared under his direction was passed to that effect. Such a notion would probably have not occurred to the mind of a geologist occupied with the purely scientific details of a new country; and it illustrates excellently well the practical turn of his character.

On the Dicotylinæ of the John Day Miocene of North America.

By E. D. Cope.

(*Read before the American Philosophical Society, February 17, 1888.*)

The number of species of peccary-like pigs whose bones are found in the John Day Miocene beds of Oregon has not been fully determined. Prof. Marsh first determined their existence in this formation, and named a species *Dicotyles hesperius*. He was followed by Leidy, who added *Dicotyles pristinus*. Marsh afterwards described two species under the names of *Thinohyus lentus* and *T. socialis*. The present writer, at a still later date, added three species under the names of *Chœnohyus decedens*, *Thinohyus trichœnus*, and *Palæochœrus subæquans*. My present object is to endeavor to determine the relations of these species to each other and to species and genera of pigs already known.

In the first place none of these species belong to the genus Dicotyles. Their premolars are quite distinct in composition from the true molars as in primitive mammalia generally. In Dicotyles the first in both jaws are identical with the true molars, or nearly so, and the preceding molars have internal tubercles, which the Miocene species do not possess. In Dicotyles there is also a preglenoid crest, which is wanting from the species in question. In all of these points the latter agree with Hyotherium von M. (*Palæochœrus* Pomel), of the Miocene of Europe.

The full descriptions given by Gervais, and especially by Filhol, of this genus, enable the fullest comparisons with the American species to be made, at least as regards the cranial and dental characters. From these it results that the latter must be referred to one or more genera distinct from Hyotherium. The principal distinction is seen in the development of the canine teeth in the American forms, and the adaptation of the opposed part of the cranium to the inferior canine. The canines are subtriangular in section, and the inferior tooth is received into a deep fossa of the premaxillary and maxillary bones, as in Dicotyles. In Hyotherium no such fossa exists, and the canine teeth are of relatively small size and of ordinary form. The Oregon species represent one or more genera intermediate in characters between Hyotherium and Dicotyles.

Two generic names have been proposed for these animals—Thinohyus Marsh, 1875, and Chænohyus Cope, 1879. The former is distinguished by Marsh from Dicotyles as follows:* "The most noteworthy differences seen in the remains under description are, an additional premolar in the lower jaw, and the extension of the posterior nares between the last upper molars. The orbit is not enclosed behind, and there is no antorbital fossa. The brain was small, less than one-half the size of that of a Dicotyles of the same bulk—and much convoluted. There is a strong bony tentorial ridge. The molar teeth have the principal cusps more isolated than in Dicotyles and the intermediate lobes larger." It will be observed

* American Journal Sci. Arts, 1875, p. 248.

that this description does not refer to the characters of the premolar teeth which really distinguish these forms from Dicotyles. I also find the tubercles of the molar teeth in numerous examples rather less distinct from each other than is the case in the *Dicotyles torquatus*. Nor do I find the posterior nares to advance between the molars in any of my specimens which are not broken, but, on the contrary, this orifice is generally posterior in position to that which it occupies in Dicotyles. Disregarding these discrepancies, Mr. Wortman and I attempted to redefine this genus,* so as to represent the characters of the species known to us. I am now, however, inclined to think that we were premature in this endeavor, and that it is quite possible that we are yet unfamiliar with the true Thinohyus. As an attempt has been made to define the genus by Marsh, the name will have to be retained, but we must await fuller descriptions both of the genus and of its typical species, before we shall be able to give it its proper place in the system.

My specimens resolve themselves into two series, those which have three premolars in the upper jaw, and those which have four. I do not know of any specimen which has but three premolars in the lower jaw. The fourth premolar (first of the old nomenclature) of the superior series is a small tooth, and may be in some instances subject to irregularities. However, I retain the two genera, and compare them as follows :

Dicotylidæ with premolar teeth all different from true molars.
Inferior canine received into a deep fossa of the upper jaw ; canines subtriangular in section ; three superior premolars.....*Chænohyus.*
Like the last, but four superior premolars.....*Bothrolabis.*
Canines with oval section, not received into a fossa of the upper jaw ;
Hyotherium.

It may be remarked of the John Day species, that there is no such excess of development of the first superior incisor in them as is seen in Dicotyles, and especially in Hyotherium. Three are constantly present in each premaxillary bone ; but each mandibular ramus may have two or three.

In the following descriptions the notation of the premolars used by Kowalevsky and Schlosser has been adopted ; viz : p. m. i is the next tooth to m. i.

Lithographic plates of these species have been printed, but cannot be published owing to the change of organization of the U. S. Geological Survey.

CHÆNOHYUS Cope.

Proceeds. Amer. Philos. Society, 1879, p. 373.

CHÆNOHYUS DECEDENS Cope, l. c.

This species was established on a large fragment of the cranium, which includes the orbits and all anterior to it, excepting the dentigerous portion

* Fourteenth Report of the State Geologist of Indiana, 1884, Part II, p. 17. Proceeds. Amer. Philos. Soc., 1887, p. 384.

of the premaxillary bone. It contains the posterior four molars, with the alveolæ of the anterior three premolars and the canine of the left side. The specimen belongs to the collection of Prof. Thomas Condon, of the University of Oregon, who kindly lent it to me.

The skull is remarkable for the abrupt contraction of its outlines anterior to the orbits, both laterally and vertically. The frontal region above and anterior to each orbit is swollen, indicating large sinuses. The anterior orbital border is notched twice, the superior emargination being rather shallow, while the inferior projects in an angle forwards, and the lachrymal foramen enters at its apex, just within the facial border. The muzzle is contracted, compressed, and short. The zygomatic arch springs abruptly, its external surface meeting the everted facial surface in an obtuse vertical angle. This angle is opposite the anterior edge of the second true molar. Its posterior base is opposite the second pair of cusps of the third true molar. The external face of the maxillary bone is directed inwards and backwards from this point, and forms a vertical angle opposite the internal margin of the last molar. Its internal border, commencing at this angle, extends forwards, but I cannot in the specimen distinguish it from the adjacent parts of the palatine bone, on account of its injured state. The palate is flat except next the molars, where its surface is recurved. The frontal region is flat, except at the superciliary borders, where it is slightly decurved.

The nasal bones are narrow, but they expand posteriorly so as to have a width three times as great as at the middle of the length. The posterior outline of both is a single convexity, whose middle point is at the line connecting the anterior border of the orbits. The length of contact of the nasal with the maxillary bones is 12 to 15mm. The lachrymal bone is higher than long, and wider above than below. Its anterior suture is nearly straight. The anterior part of the malar is deeper than the lachrymal, and its anterior suture is concave posteriorly.

The lachrymal foramen is single and round. The infraorbital foramen is vertical and is above the posterior border of the first premolar. The incisive foramina are large. The supraorbital foramina are close together, being separated by an interspace equal one-fourth that which separates each from the superciliary border. The grooves which extend from them anteriorly diverge gradually and are lost near the apices of the premaxillary bones. The palatine foramen is opposite the line of contact between the first and second true molars.

The dental series is remarkable for the rapid diminution of dimensions of the teeth from behind forwards. The last molar is fully equal in size to the corresponding tooth in the *Bothrolabis pristinus*, but the first true molar and first premolar are very much smaller than in that species. The same relation exists between this species and the *B. subæquans*. In comparison with the *B. trichænus*, the anterior teeth are smaller, while the last true molar is larger, in the *C. decedens*. The crowns of the molars are of simple constitution. They consist of four cusps, two external and two internal, the

latter a little benind opposite the former, and connected with them by an obscure intermediate tubercle. The latter is so far fused to the other two as to give a pair of transverse ridges somewhat depressed in the middle. The posterior intermediate on the last superior molar is a little in front of the larger ones which it connects, and a third intermediate is situated behind the space between the latter. This third intermediate is an upward production of a broad cordiform posterior cingulum of the crown. The external cusps on all the true molars in this species are remarkable for having their external faces flat, having thus distinct anterior and posterior edges. The internal face is convex to angular. There is a complete delicate external cingulum, and a wide anterior cingulum, but no internal cingulum. The first premolar has a nearly square outline instead of being transverse, as in the other species, and has one external and one internal cusp, connected by an elevated ridge. No rudiment of external second cusp. The internal cusp is much smaller than the external. A complete cingulum, except on the internal side; the external a delicate one. Second premolar with greater anteroposterior extent than the first. Its base contracts inwards through the obliquity of the external side. The crown is lost. The internal outline of the last four molars is straight, the external a little convex. The second premolar's form adds to the convexity. The alveolar border in front of the second premolar is broken, but there is no trace of alveoli or roots of another premolar until we approach the canine alveolus. Here a single root indicates a rather small fourth (or ? third) premolar. Its long diameter is directed inwards and forwards. The canine is large, but the root only remains in the alveolus. Its outline is that of an isosceles spherical triangle, with the apex directed posteriorly and outwards. Its alveolus occupies an enlargement of the maxillary bone, which is excavated on the anterior face to receive the apex of the inferior canine. This fossa has an acute posterior and superior border. In front its border is excavated by the alveolus of the large third superior incisor.

Measurements.

		M.
Interorbital width		.085
Depth to alveolar border at front of orbit		.080
Length from orbit (between notches) to canine fossa		.091
Width of palate at p. m. i		.0255
" " " m. iii (middle)		.024
Length of molar series		.0815
" " true molars		.044
" " base of p.m. ii		.010
Diameters p.m. i	anteroposterior	.0085
	transverse	.0095
Diameters m. i	anteroposterior	.0115
	transverse	.0125

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		M.
	Measurements.	
Diameters m. iii	anteroposterior	.018
	transverse	.016
Diameters base of canine	anteroposterior	.019
	transverse	.009

As compared with the collared peccary this species has a skull of about the same size, but rather more robust. The posterior molars are considerably more robust.

BOTHROLABIS Cope. Gen. nov.

The species of this genus known to me differ as follows. It may be remarked that they differ from those described by Marsh in their superior size. The latter are represented as being smaller, sometimes much smaller, than the common peccary. Those now described are equal to or larger than that species. The type of the genus is the *B. rostratus* Cope. It very probably includes the *Hyotherium americanum* S. & O.*

I. Muzzle short; a rudimental second external cusp of superior p.m. i.

Superior true molars longer than space from m. i to canine; last superior molar wide as long; fourth inferior premolar one-rooted; infraorbital foramen above middle of p. m. i.....*B. subæquans.*

II. Muzzle medium; one external cusp to superior p. m. i.

Superior true molars as long as space between p. m. i and canine; inferior p.m. iv two-rooted; infraorbital foramen above middle of p. m. ii; last superior molar longer than wide, with three cross-crests and no internal cusp at first valley.....*B. pristinus.*

As in *B. pristinus,* but fourth inferior premolar with one root, and superior m. iii with two rows of tubercles, and an internal tubercle at end of anterior valley..... *B. trichænus.*

III. Muzzle long, compressed; superior p. m. i with one external cusp.

Molars small; true molars shorter than space from m. i to canine, last longer than wide, with two rows of tubercles; infraorbital foramen above middle of p. m. ii.....*B. rostratus.*

These species, with the *Chænohyus decedens,* form a series, which is measured by the increasing length of muzzle, and various other but consequent characters. One of these is the forward movement of the infraorbital foramen, and the anteroposterior development of the fourth inferior premolar. In addition to these, the series displays a coincident posterior extension of the base of the zygomatic arch. In the *C. decedens* it is anterior to the posterior border of the last superior molar. In the *Bothrolabis subæquans* it is opposite the same. In the *B. pristinus* it is posterior, and in *B. rostratus,* very much posterior to the last superior molar.

* Preliminary account of fossil Mammals from the White River formation; Bullet. Mus. Compar. Zoöl., Cambridge, xiii, 5, p. 155, 1885.

Bothrolabis subæquans Cope.

Palæochærus subæquans Cope. Proceeds. Amer. Philos. Soc. 1879, p. 374.

This species is only known to me from a single nearly entire skull with lower jaw in the collection of Prof. Thomas Condon, of the University of Oregon. The specimen he kindly lent to me, and my description and figures are based upon it. It is distinguished among those of its congeners by its abbreviated and robust form. This is seen in the steepness of its profile, the concavity of the side of the muzzle, and in certain details. Such are the position of the superior p. m. iv within the superior canine; the absence of diastemata between the premolars, and the shortness of the last true superior molar.

The frontal region is swollen above the anterior parts of the orbits, but is concave in front of the temporal ridges, except at the median line, which is obtusely keeled at this point. The profile does not descend abruptly as in the *Chænohyus decedens*, but forms a steeply descending straight line. In the same way the face is not abruptly contracted at the front of the malar bones, but slopes rapidly inwards, giving a wedge-shaped outline from above. Anterior to the compression the facial surface expands laterally and encloses the canine alveoli without abrupt enlargement. Anterior to these teeth the fossæ for the inferior canine are excavated upwards and backwards to a depth of about one-fourth the vertical diameter of the muzzle, the molar teeth being held horizontally. The greater part of the premaxillary bones are broken off. The orbit is not large. The postorbital process is large and decurved, with its compressed-acute apex pointing downwards, behind the line of the postorbital process of the molar. The anterior border of the orbit has two notches, the inferior the larger and including the lachrymal foramen. The supra-orbital border is nearly straight. The temporal ridges are sharply defined. The sagittal crest is compressed and deep through the posterior depression of the brain case, as it does not quite rise to the plane of the facial profile. The occiput is narrow and elevated, and its lateral crests are prominent, enclosing a spoon-shaped occipital fossa. The inion is a narrow truncate angle less than right. The occipital condyle projects at its superior part, exterior to the vertical line of the lateral occipital crest. The crest extends directly towards it without reaching it, and does not turn anteriorly to bound the temporal fossa below as in most Mammalia, including the peccary. It follows that the paroccipital and zygomatic crests originate independently. The latter is prominent, rising abruptly above and sloping backwards and inwards to a prominent apex nearer to the occipital condyle than to the postglenoid process. It has a deep transverse groove on its external face. The posttympanic region is a flat bone spread out against the posterior aspect of the zygoma as in pigs generally. Its flat posterior plane is nearly vertical. Below its inferior border projects the postglenoid process, which is narrow, thinning out and becoming more

prominent externally. At the superior border of the end of the post-tympanic plate the *meatus auditorius externus* issues. The posterior extremity of the angle of the zygoma rises above it, presenting a concave triangular face posteriorly, the apex upwards. The glenoid surface of the zygoma is horizontal in front, but its external half posteriorly rises externally. The otic bulla is larger than in any of the species here described, but its entire boundaries have not been exposed. Its transverse diameter is equal to the space between the apices of the paroccipital and posttympanic ridges. The zygomatic arch is rather short, its external face is flat, and its vertical depth is considerable. Its posterior angle is very prominent and compressed. The occipital condyles are small for the size of the skull.

The mandibular condyle projects very little vertically or posteriorly, but has considerable transverse extent. Its posterior face is in fact vertically truncate and the posterior border of the coronoid process rises directly from the anterior border of its superior aspect. The anterior edge of the coronoid conceals the posterior extremity of the third inferior molar. The inferior edge of the ramus is compressed and straight anteroposteriorly, and a little convex downwards. The symphysis rises obliquely but more steeply than the curvature of the ramus. Its median suture is preserved. The posterior base of the zygomatic arch is in transverse line with the posterior border of the third superior molar tooth. In *Chænohyus decedens* it is anterior to this line, and in *Bothrolabis pristinus* and *B. rostratus* it is much posterior to this line. The masseteric fossa is well marked but shallow in the vertical direction, not descending below the line of the inferior molars.

The nasal bones are narrow medially, but expand at a point opposite the anterior border of the lachrymal bone to four times that width. At the middle line posteriorly they present posteriorly an angle which is about right. The coronal suture crosses the angle formed by the converging temporal ridges, in a nearly straight short line. The apex of the premaxillary does not reach the frontal bone by 35 mm. The latter borders the maxillary by about 10 mm. The lachrymal is about as long as deep, and presents an angular process backwards into the orbit. The malar rises to opposite the lachrymal foramen, and its anterior border does not project beyond that of the lachrymal, and retreats a little posteriorly below. The posterior suture of the malar is not very oblique; it is concave and reaches the base of the postorbital process. The alisphenoid bone has little or no contact with the pariëtal. The latter descends more than half way to the base of the zygomatic process, and reaches the inion posteriorly. The posterior border of the squamosal is anterior to the lateral occipital crest.

The infraorbital foramen is above the middle of the first superior premolar. The supraorbital foramina are close together, being separated by an interspace which is one-seventh of the interorbital space. The lachrymal foramen is single, large, and within the orbital border. There are

three postpariëtal foramina, the inferior small and on the squamosal suture. The mastoid foramen is small, is anterior to the lateral occipital crest, and is apparently on a suture. There are two supraglenoid foramina, both small, the larger on the inner side of the base of the zygoma. The *meatus auditorius externus* is small, and is directed upwards and outwards. There is a foramen on the inner aspect of the line of contact of the posttympanic and postglenoid plates, which is probably continuous with the postglenoid. The stylomastoid foramen is, externally at least, longer than the postglenoid. The superior border of the foramen magnum is an open angle.

Of the superior incisor teeth only the third is preserved. The crown is oval and of moderate width. There were two inferior incisors in each ramus. Of the presence of a third I am very doubtful. They have rather narrow truncate crowns of equal width, and are directed upwards at an angle of 45°. The canines are robust. They have a subtriangular section, but the inferior triangle has a truncated (anterior) apex. These teeth differ from those of *B. pristinus* and *B. trichœnus* in having two grooves separated by a ridge on the external sides, instead of one groove. The narrow anterior face of the inferior canine is also shallowly grooved.

The fourth superior premolar is almost entirely within the superior canine. It is small, but two-rooted. The third is much longer, and is much compressed. The second is but little longer than the third. Its crown consists of a single compressed cusp, with an internal cingulum which expands posteriorly, enclosing a narrow basin, and turning outwards forms a narrow basal heel. The first premolar has a base wider than long. Its external tubercle is bifid, the principal one supporting a rudiment of a second. The internal cusp is connected with the external by a transverse ridge, which does not reach the apex of the latter. A wide cingulum forms the internal and posterior outline of the crown. A narrow external, and no internal cingulum. The true molars are subquadrate in form, and increase in size posteriorly. The first is not so reduced in relative proportions as in the *Chœnohyus decedens*. The external cusps are a little flattened externally, not so conspicuously as in the last-named species. Intermediate tubercles are present as in that species. An anterior and a posterior, a faint external and no internal cingula. The posterior cingulum is wide in the second molar and supports a rudimental third intermediate tubercle. In the third true molar it is wider and has a plicate border, but no considerable cusp. The second transverse series of tubercles of this tooth consists of those tubercles besides the intermediate tubercle in front of it, instead of two as exhibited by the other species. The external tubercle of this series is flattened on the external side. The intermediate tubercle of the first row is large and distinct. The crowns of the inferior molar teeth are not visible in this specimen. It can be seen, however, that the only diastemata in the series are very short, and are anterior and posterior to the fourth one-rooted premolar.

Measurements.

	M.
Length from I. iii to inion (axial)	.205
" " " " postorbital apex	.135
" " " " anterior border of orbit	.098
Width of occiput (greatest)	.033
" at zygoma at auditory meatus	.094
" of brain case (greatest)	.043
" at postorbital processes	.088
" " zygoma at front of orbit	.082
" " facial constriction	.048
" " canine alveoli (external)	.062
Least interorbital width	.070
Elevation of inion above foramen magnum	.0545
Vertical diameter of zygoma behind orbit	.022
" " " " at "	.022
" " " orbit	.030
" " " cranium at front of orbit	.070
" " " " at third premolar	.050
" " of mandible at p. m. iv	.025
" " " " " m. i	.039
" " " " " m. iii	.039
Length of superior molar series	.088
" " superior true molars	.048
Diameters superior p. m. i { anteroposterior	.010
Diameters superior p. m. i { transverse	.012
Diameters m. i { anteroposterior	.015
Diameters m. i { transverse	.014
Diameters m. iii { anteroposterior	.0165
Diameters m. iii { transverse	.015
Diameters of superior canine { anteroposterior	.016
Diameters of superior canine { transverse	.010
Diameters crown of inferior canine { anteroposterior	.012
Diameters crown of inferior canine { transverse	.0095
Width of crown of I. i inferior	.006
" " " I. ii	.0055

The skull of this species has just the length and elevation of that of the collared peccary, but is more robust.

BOTHROLABIS PRISTINUS Leidy.

Dicotyles pristinus Leidy, Report U. S. Geol. Survey of the Territories, F. V. Hayden, 1873, I, p. 216; Pl. vii, figs. 13–14. *Palæochærus pristinus* Leidy, Cope, Bulletin U. S. Geol. Surv. Terrs., 1879, v, p. 58.

Of what I suppose to be this species I have a nearly complete skull without lower jaw, and a lower jaw from which the anterior teeth are

wanting, and a number of tooth-bearing fragments. I found a ramus with symphysis and part of the other ramus of an individual in Prof. Condon's collection, which I refer for the present to this species. The identification rests on the characters of the last two inferior molars, the only parts in the possession of Leidy when he described the species.

The skull is in its proportions intermediate between the extremes in the genus. The profile of the long muzzle is a nearly straight gradually descending line. Viewed from above the muzzle contracts gradually to the compression behind the canine alveoli, and then expands to contract abruptly in front of the latter, to terminate in the parabolic outline of the premaxillary region. The sagittal crest is mostly lost, but it is pretty certain that it descends from the profile line to the inion, which is below the frontal level. The ridge of the muzzle does not expand above the canines. The zygomata are flat. The interorbital region has an undulating surface, owing to the presence of swellings on each side of the middle line, and of a depression at the supraorbital foramina, and an obtuse median keel behind them. The postorbital processes are robust and decurved abruptly, the apices connected with the skull by a transverse plate with horizontal inferior edge. The superciliary border is carried a little anterior to the anterior border of the orbit. This border is only distinct above the lachrymal foramen; below that point the passage from the facial to the orbital surface is uninterrupted. The anterior origin of the zygomatic arch is equally gradual; posteriorly it arises from the posterior edge of the maxillary bone, which forms a line posterior to the third superior molar by 5 mm. Before reaching the longitudinal line of the malar, the border turns backwards and terminates in an apex which is directed backwards and inwards close to the pyramidal process of the palatine bone, from which it is separated by a fissure. The postorbital process of the malar bone is small, compressed and acute. It is anterior to the line of the postorbital process of the frontal. The superior edge of the zygoma is acute; the inferior beveled and truncate. The lachrymal bone extends downwards within the anterior part of the orbit and forms a prominent convexity whose long axis runs downwards and inwards, and it projects behind the posterior boundary of the maxillary bone. It encloses with the superior wall of the latter a deep fossa below and continuous with the orbit. The orbit is bounded posteriorly by a curved ridge which rises behind the foramen rotundum to near the base of the postfrontal process and turns forwards and disappears. A much more prominent angle commences behind the foramen rotundum and rising vertically soon disappears. The temporal ridges are pronounced, and are concave forwards. The lateral occipital crests are prominent and descend to near the condyles. The posterior temporal ridge is weak and continued subhorizontally from the zygoma behind, but it does not reach the lateral occipital crests. The paroccipital process has a robust base which stands at an angle of 45°, being less nearly vertical than in the *B. subæquans*. It approaches nearer to the posttympanic plate than in that species, being

separated by a groove at its apex. The posttympanic is a flat fan-shaped bone appressed close to the postglenoid process. Its inferior edge forms a ridge running horizontally inwards and posteriorly, and enclosing a triangular space with the postglenoid, which is pierced by the postglenoid foramen. Between the foramen and the bulla of the ear is a small pisiform tuberosity. The otic bulla is small, and its long axis is longitudinal; its width is a little greater than the space between it and its fellow, and equals the space between the apex of the postglenoid process and the nearest point of the paroccipital. The basioccipital is weakly keeled at the middle line behind, but it is grooved at the anterior edge through the presence of a tuberosity on each side of the middle line. The groove soon disappears on the sphenoid. The inferior ala of the sphenoid forms with the pyramidal process of the palatine a long wall, which extends from the posterior contact with the maxillary bone to the internal base of the glenoid cavity. Its inferior margin is double, or grooved, the exterior edge being deeper posteriorly, the interior the deeper anteriorly. The posterior nareal border is divided by an osseous septum of 15 mm. in length on the inferior edge; the anterior border of the nares attains the line of the posterior edge of the last superior molars. The palate is flat, except a slight recurvature at the bases of the molars.

The sutural boundaries of the nasal bones are about the same as in the *B. subæquans*. Their anterior extremities are fortunately preserved. They are deeply notched, so as to be bifurcate, the internal angle being about as long as the external. The facial part of the lachrymal is subquadrate and its anterior suture forms a nearly straight line with that of the malar bone. The superior squamosal suture reaches half way to the sagittal crest, but not to the lateral occipital. The maxillopalatine extends anteriorly to a point opposite the middle of the first true molar. The premaxillary extends to within 50 mm. of the frontal, while the latter touches the maxillary by a suture of 10 mm. in length.

The *foramen magnum* is small. The lachrymal is single. The infraorbitale issues above the middle of the p. m. ii. The supraorbitals are close together, being separated by a space equal to one-eighth the interorbital width. The *f. opticum* is rather large and is quite distinct from the *f. rotundum*, though near it. The latter and the *f. sphenoörbitale* appear to be united into a single large orifice. The *f. ovale* and *f. lacerum anterius* are not distinct. There is no *f. lacerum medius*, and the *f. lacerum posterius* is very narrow. The *f. stylohyoideum* is rather large; the *f. postglenoïdeum* looks downwards and inwards from between the posttympanic and postglenoid plates. The *f. condyloideum* is well isolated; it is oval and looks downwards. The *f. magnum* is a wide transverse oval. The *meatus auditorius externus* looks upwards into a triangular groove-like fossa of the triangular posterior face of the zygoma. There is one large postparietal foramen. No supraglenoid foramen. Mastoid foramen small, below the edge of the posttemporal crest. Palatine foramina opposite the middle of the first true molar.

The animal described is mature, and the crowns of the first and second true molars have lost their patterns by attrition. The fourth premolar is small, but is two-rooted, the anterior root nearly reaching the posterior edge of the canine alveolus. The third premolar is like it but larger, the second is still larger, and has the external cusp and internal cingulum spreading posteriorly as in the other species. The first premolar is wider than long and has but one external cusp; it has anterior and posterior, but no external nor internal cingula. The true molars have all the cingula but the internal. The third true molar has three transverse dentinal tracts besides the posterior cingulum, indicating three rows of cusps. The external cusp of the second row is distinct from the others and of conic form; it is bounded externally by the cingulum.

The canine has a single external median groove. Its section is triangular, but the anterior face is not so wide, and the posterior edge not so acute as in the *B. subæquans*. The fossa for the inferior canine enters the premaxillary to a depth equal one-fourth that of the muzzle at that point. In the *B. rostratus* it excavates to a depth of one-half the muzzle. Of the superior incisive alveoli, the first is a little larger than the third, and the third a little larger than the second.

Measurements of skull.

	M.
Length from premaxillary bone to probable inion	.250
" " " " postorbital apex	.175
" " " " preorbital border	.155
" " " " infraorbital foramen	.080
" " " " superior canine	.035
" " " " posterior nares	.148
Length of otic bulla	.0245
Width of otic bulla	.014
" of occiput (greatest)	.040
" at zygoma at auditory meatus	.110
" " " at front of orbit	.100
" of brain case (greatest)	.059
" at postorbital processes	.096
" " facial constriction	.034
" " canine alveoli (external)	.056
" " " " on palate	.034
" between p. m. i.	.024
" " m. iii	.022
" of posterior nares	.0105
" between otic bullæ	.0115
" of foramen magnum	.016
" between orbits (least)	.081
Vertical diameter of zygoma behind orbit	.0225
" " " " at orbit	.0225

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Measurements of skull.	M.
Vertical diameter of orbit	.034
" " " cranium at front of orbit	.078
" " " " " third premolar	.065
Length of superior molar series	.093
" " " true molars	.049
Diameters superior p. m. i { anteroposterior	.0095
Diameters superior p. m. i { transverse	.013
Diameters superior m. i { anteroposterior	.013
Diameters superior m. i { transverse	.015
Diameters m. iii { anteroposterior	.020
Diameters m. iii { transverse	.0165
Diameters superior canine { anteroposterior	.015
Diameters superior canine { transverse	.009

The skull of this species exceeds that of the collared peccary, and is equal to that of the larger *Dicotyles labiatus*.

The lower jaw belonging to Prof. Thomas Condon, to which reference has been made, is referred with some doubt to this species. This is because it is accompanied by a superior posterior molar, which has not the characters of that of the *B. pristinus* in the lack of the third transverse series of tubercles. It is, however, not certain that this tooth belongs to the animal represented by the lower jaw.

In the latter there are two well-developed incisor teeth and an alveolus for a much smaller external one on each side. The fourth premolar is two-rooted and is separated by diastemata from the canine and from the third premolar of about the same length as itself. The other molars are in an uninterrupted series. The inferior molars have anterior and posterior cingula, but no external or internal ones. On the first and second there are no intermediates; on the third they are represented by median swellings in the bottoms of the transverse valleys. The heel is well developed supporting a median tubercle and lateral crenate edges. A narrow anterior cingulum. These inferior molars have the characters of the specimens described by Leidy as typical of the species.

Measurements.

	M.
Width between inferior canines	.013
Diameters of m. ii { anteroposterior	.0175
Diameters of m. ii { transverse	.013
Diameters of m. iii { anteroposterior	.021
Diameters of m. iii { transverse	.0125
Depth of ramus at m. ii	.035

Bothrolabis trichænus Cope.

Thinohyus trichænus Cope. Proceeds. Amer. Philos. Society, 1879, p. 373.

Established on a nearly complete dentition of both jaws in place, but

sufficiently open to display the crowns of the teeth. The rest of the skull is mostly wanting, though some parts of the base are probably preserved in the mass of matrix.

The first incisor is directed nearly vertically downwards. The external face of the crown is an oblique, wide vertical oval, convex on the internal and obliquely truncate on the external edge. The crown of the second incisor is smaller and more acuminate ; there is no such difference in size between it and the first, as in *Hyotherium waterhousei* and other species of that genus, and both teeth are smaller than the corresponding ones in the *Dicotyles torquatus*. The superior canine is very robust. Its posterior edge is sharp, and the external face is flat, with a longitudinal shallow groove near the middle. The fourth premolar is wanting from both sides, but a space close behind the canine is probably its alveolus. A short interspace separates it from the third premolar. The latter has two roots and its base is nearly as long as that of the second premolar. The crown is lost. The second premolar is longer than wide, and is wider behind than before. It consists of an external cusp which has an angular apex of moderate elevation, and a basal internal cingulum. The latter arises posterior to the anterior base of the crown as a narrow ridge, and speedily expands posteriorly, enclosing a basin with the external cusp. It does not rise into a tubercle. The first premolar is as wide as long, aud has a subquadrate base. It has but one, a simple external cusp, from the anterior part of which a transverse straight ridge extends inwards and ceases abruptly above the internal base. The posterior base of the tooth is therefore expanded, forming a table, while there is a rudimental anterior cingulum. No internal or external cingula.

The first and second true molars are of subequal dimensions,and are larger than the first premolar. The base of the first is subquadrate and slightly oblique. Its four cusps are connected by wear, so that I cannot determine the presence of intermediate tubercles excepting one near the centre of the crown. A cingulum, except on the inner side ; the external faint. In the second true molar two intermediate tubercles are visible, but the anterior is fused with the external and internal anterior tubercles, so as to form a transverse crest, depressed in the middle. The posterior intermediate is in front of the posterior pair of tubercles, and there is no third or posterior cingular tubercle. Cingulum present except on inner side of crown, faint on external side. The third true molar is composed like the second, with the addition of a heel, and a tubercle on the inner side stopping the valley between the two cross-crests. The intermediate tubercles of this tooth are more conspicuous than in the m. ii. and the anterior is of equal elevation with the interior and exterior of the first row. This row is now quite oblique, looking posteriorly inwards. The heel has a median tubercle about the size of the second intermediate, which is flanked on each side by a plicated border or outline. The enamel of all these teeth is smooth.

There are three incisors in each ramus of the lower jaw. Their crowns

are of subequal size, but their edges are differently worn. The first and second are squarely truncate, the third obliquely on each side, so as to give an angular apex. The inferior canine is robust, with the apex directed upwards. The section is subtriangular, with a rather obtuse apex anterior. The external face is flat, and has an open shallow longitudinal groove, which is cut by the face of attrition not far below the apex. Enamel smooth. The fourth premolar is a small tooth with one root entirely behind the canine. It is separated by a very short interspace from the third premolar. It is not clear whether it has one or two roots. The second premolar has a compressed simple crown without cingula. The posterior base is broken off. The first premolar has two subequal closely appressed cusps, anterior to the middle of the crown. In front there is a basal angle ; posteriorly a long heel, whose elevated longitudinal ridge is external to the middle line.

The first true molar is wanting. The second displays a crown a little longer than wide. It supports four cusps, without intermediates, whose bases are joined so that wear causes their dentinal centres to become continuous. A swelling in the valley represents the second intermediate cusp, while a similar swelling of the posterior cingulum represents the third. Cingula are represented by a posterior and anterior basal ledge. The third inferior true molar has two pairs of cusps and a large heel, the latter embracing a median basin. A low intermediate tubercle interrupts the middle of the anterior valley, and three low confluent tubercles fill the basin of the heel. The border of the latter is tubercular, the principal one being a little exterior to its median point. No cingula, but a short anterior ledge. Enamel smooth.

Measurements.

		M.
Length of superior molar series		.091
" " true molar series		.0463
Anteroposterior diameter of superior canine		.015
Diameters p. m. ii	anteroposterior	.0115
	transverse	.009
Diameters p. m. i	anteroposterior	.0105
	transverse	.011
Diameters m. i	anteroposterior	.0132
	transverse	.0132
Transverse with crown of superior I. i		.010
" " " " inferior I. i		.0055
Anteroposterior diameter of inferior c.		.010
Length of inferior molar series		.099
" " " true molar series		.050
Diameters m. ii	anteroposterior	.015
	transverse	.012
Diameters m. iii	anteroposterior	.022
	transverse	.012

Further investigations may show this species to be identical with the *B. pristinus* Leidy. The differences at present apparent are: first, the one-rooted p. m. iv, two-rooted in *B. pristinus;* second, the relatively rather smaller molars, especially the third superior. In the *B. pristinus* this tooth has a transverse series of tubercles on the heel which are rudimental in the *B. trichænus*, and the internal tubercle which stops the anterior valley is wanting in the *B. pristinus*. As compared with the *Chænohyus decedens* this species has a longer premolar region, and larger anterior molars and premolars.

Bothrolabis rostratus Cope. Spec. nov.

A cranium nearly entire, but without mandible, represents this species. The specimen indicates a species of larger size than the white-lipped peccary (*B. labiatus*), but of more slender proportions. An important character is found in the small size of the molar teeth. In this respect it compares with the *B. pristinus* much as the black bear compares with the grizzly.

In profile the interorbital region is concave, and the sagittal crest rises above it. The prefrontal region is gently convex, and the top of the muzzle is a gradually descending straight line. Viewed from above the outline is wedge-shaped to the contraction above the third premolar, and then expanded prominently for canine alveoli. The premaxillary region is not longer than in *B. pristinus*, while the facial part of the muzzle is considerably more elongate than in that species. Its profile has no such slope as is seen in *B. subæquans*, nor abrupt descent as in *Chænohyus decedens*. There is no median frontal rib as in *B. pristinus*. The alveolus of the superior canine is produced downwards below the remaining alveolar border, so that the fossa for the inferior canine is excavated into half the depth of the muzzle instead of only one-fourth as in the species already described. This may be a character of the males only. The zygomatic arch is peculiar in that the postorbital portion is considerably shallower than the orbital portion. Its postorbital process is large. The postorbital processes of the frontal are both broken at the apices, but so far as preserved they resemble those of the other species. A little process extends into the orbit from its anterior border, below which the latter is not very well defined. The orbit is not very large, and its long axis is oblique anteroposteriorly and in the vertical plane. The posterior apex of the zygomatic process of the squamosal is broken, but it was evidently not so robust as in the species already described. The postglenoid is transverse and compressed to an acute free edge, and the posttympanic plate is closely appressed to it. The paroccipital process is elongate, and the apex contracts from the base. The latter lies at an angle of 45° inwards and forwards, rising from the edge of the otic bulla. The occipital condyles are small, and are laterally expanded. The otic bullæ are placed longitudinally and are small regular ovals. Their transverse diameter is less than the width of the space between them, and equals the space between the external bases of the postglenoid and paroccipital processes. The basi-

occipital is flat posteriorly, but anteriorly it has an open shallow median groove, with a low ridge on each side.

The occiput is damaged, but the lateral occipital crests descend to near the condyles without sending a branch to the zygoma. The posterior temporal ridge commences above the external portion of the occipital condyle. A single prominent angular ridge dividing the temporal from the orbital fossæ continues from the postfrontal process to internal angle of the preglenoid boundary. The inferior sphenoid ala is continuous from this point to and with the pyramidal process of the palatine, forming a vertical plate flared outward at its superior border. The border of the posterior nares is about as far posterior to the last superior molar as the length of that tooth, and opposite to the posterior extremity of the maxillary bone. This is further posterior than in any of the other species. The zygomatic foramen is encroached on by the convexity of the inferior part of the lachrymal bone which is in this species subhorizontal, and not oblique as in the *B. pristinus*. It is therefore continuous with the zygomatic expansion of the maxillary bone, and serves to place the posterior origin of the zygomatic arch much further back than in any of the other species here described. The outlines of the zygomatic arches are flat, and slightly wider behind than before. The palate is flat, except posterior to opposite the last superior molars. It then slopes upwards at an open angle. The premaxillary palatal face is a little decurved.

As the animal described is old, the sutures are obliterated.

The infraorbital foramen is above the middle of the second superior premolar, and is a vertical oval. The supraorbital foramina are small and close together, the space between them being one-seventh the interorbital width. There are two postpariëtal foramina placed rather low down, the inferior on the squamosal suture. A very small supraglenoid foramen on the inner side of the zygomatic process. The *foramen magnum* is wider than deep if we except a deep notch of the superior border. The *f. condyloideum* is entirely distinct, and is a longitudinal oval. The *f. ovale* is not distinct from the *f. lacerum anterius*. The *f. postglenoïdeum* is at the inner side of the postglenoid process. The meatus auditorius externus is lost with the zygomatic angle, but its canal is remarkably small. The *f. palatinum* is opposite the first true molor. The *ff. incisiva* are distinct from each other, and rather large, the two, with their septum, forming a circle.

The incisive alveoli of the premaxillary are of moderate size, and the first and third are equal, and the second a little smaller. The canine alveoli are large and pedunculate; the crowns are lost. The fourth premolar is separated from the latter by a diastema; it has a simple compressed crown, and is two-rooted. The third premolar is similar but larger, and is preceded and followed by diastemata, the former as long as itself, the latter a little shorter. The second premolar is like that of the other species of the genus. The first is wider than long, and has one external and one internal cusp, and posterior and anterior cingula, the former the wider. The crowns of the first two true molars have lost their

pattern through wear. That of the third is but little larger than that of the second. Its posterior border is obliquely convex, being most prominent at the internal side. It has two cross-rows of cusps and a heel, the latter with an internal cusplet. The intermediate tubercles are distinct, and there is one in the valley between the two rows. This tooth has only a trace of an external cingulum, and no internal one.

Measurements.	M.
Length from premaxillary bone to foramen magnum inclusive	.270
" " " " postorbital process	.228
" " " " preorbital border	.185
" " " " infraorbital foramen	.105
" " " " superior canine	.040
" " " " posterior nares	.173
" of otic bulla	.0215
Width " "	.016
" at zygoma at auditory meatus	.098
" " " " front of orbit	.118
" of brain case (greatest)	.026
" at postorbital processes	.083
" between orbits (least)	.078
" at facial constriction	.041
" " canine alveoli (external)	.059
" " " " on palate	.036
" between p. m. i	.029
" " m. iii	.033
" of posterior nares	.011
" between otic bullæ	.016
" of foramen magnum	.018
Vertical diameter of cranium at last molar	.079
" " " " " third premolar	.043
" " " orbit	.035
" " " zygoma at orbit	.024
" " " " behind orbit	.016
Length of superior dental series	.152
" " " molar "	.089
" " " true molars	.044
Diameters of p. m. i { anteroposterior	.010
Diameters of p. m. i { transverse	.013
Diameters of m. i { anteroposterior	.013
Diameters of m. i { transverse	.014
Diameters of m. iii { anteroposterior	.018
Diameters of m. iii { transverse	.0125
Diameters canine alveolus { anteroposterior	.016
Diameters canine alveolus { transverse	.0135

From the John Day bed of Oregon, on Camp Creek. Discovered by Dr. J. L. Wortman.

On the Mechanical Origin of the Dentition of the Amblypoda.

By E. D. Cope.

(*Read before the American Philosophical Society, February 17th, 1888.*)

As the Amblypoda form the only order of ungulate Mammalia with tritubercular superior and tuberculo-sectorial inferior molars, the question has arisen in my mind why they did not develop a sectorial dentition in the same way, and for the same mechanical reasons, that the unguiculate series has done so. Having recently assigned* certain mechanical reasons for the evolution of the sectorial teeth of the Carnivora, it is necessary to explain why the Amblypoda, which had apparently the same mechanical conditions at the start, did not eventually produce the same result.

In the first place I observe in the families Coryphodontidæ and Uintatheriidæ of the Amblypoda, that the shearing the inferior molar crests against the superior molar crests, is from before backwards. In the Creodonta and Carnivora it is from behind forwards. I supposed the latter movement to be due in these animals to the wedging of the inferior canine in front of the superior canine, a movement undoubtedly sufficient to account for such a shearing, other things being equal. But in the Coryphodontidæ the canines are greatly developed, yet the shearing of the molar crests is in the opposite direction. It is also evident that the development of the canines cannot have been the cause of the maintenance of any kind of a shear between alternating parts of molar teeth, otherwise the quadritubercular type of molar would not have come into existence in such families as have large canine teeth, such as the Suoïd Artiodactyla. I do not for these reasons abandon the opinion that the development of the canines has not had a great deal to do with the development of the sectorial dentition. I only deny that it has been the cause of its *origin*, that is, of the anterior shearing of the lower molars on the upper, at its beginning.

The divergence of mammalian dentition into the two types, the tritubercular and quadritubercular, has been, as it appears to me, due to the adoption of different food-habits. The tritubercular is the primitive, and is adapted for softer food, as flesh, so that primitive placental Mammalia were carnivorous or nearly so. The mastication of hard food was impossible until the molars of the two series opposed each other, and this was not accomplished until the quadritubercular superior molar was produced. This was accomplished, as I have pointed out, by the addition of a posterior internal tubercle, and I suspect that the mechanical cause of its origin was the attempt of the animal in mastication to crush substances harder than flesh against this posterior edge of the superior molar, by applying to it the anterior edge of the lower molar. In the devouring of flesh this movement is not necessary or only necessary so far as to produce a shear-

* The Mechanical Origin of the Sectorial Teeth of the Carnivora. Proceeds. Amer. Assoc. Adv. Sci. 1887, p. 254.

ing movement to cut a resisting ligament or tendon. The different mechanical movements in the two cases were due to the manipulation of its lower jaw by the animals, just as we may see them to-day endeavoring to masticate substances in accordance with their hardness, form, etc. It would appear in the case of the tritubercular superior molar, that the impact during the effort to masticate hard and tough substances, as vegetable tissues, and seeds, has had its usual effect to stimulate deposit of material. The shearing movement has had an opposite effect, viz., that of wearing away the surface subjected to it, and the flattening of the sheared face. That the development of the grinding mastication should take place in ungulate Mammalia is entirely appropriate to the structure of their digits; the hoofed structure unfitting them for the seizure of living prey.

In the Amblypoda, however, we have a hoofed order in which the primitive tritubercular superior and tuberculo-sectorial inferior molar remained. Of the three families, the latest, the Uintatheriidæ, display the greatest anomaly, while the earliest, the Pantolambdidæ (of the Puerco) give the simplest known type. It is to the intermediate family, the Coryphodontidæ of intermediate age (the Wasatch Eocene) that we must first look for the explanation of the peculiar characters of the order.

Before doing so I give an explanation of the various mechanical types of mastication:

I. Part or all of inferior molars work between superior molars. Amœbodect mastication.

1. The inferior molar shears forwards on the superior molar. Proterotome mastication; Creodonta, Carnivora.
2. The inferior molars shear posteriorly against the superior molars. Opisthotome mastication; Coryphodontidæ, Uintatheriidæ.

II. Molar teeth of both jaws oppose each other. Antiodect mastication.

3. The movement of the lower jaw is vertical. Orthal mastication; Suoïdea, Tapiridæ.
4. The movement of the lower jaw is from without inwards. Ectal mastication; many Perissodactyla.
5. The movement of the lower jaw is from within outwards. Ental mastication; most Artiodactyla; some Perissodactyla.
6. The movement of the lower jaw is from before backwards. Proal; most Rodentia.
7. The movement of the lower jaw is from behind forwards. Palinal; Proboscidia (Ryder).

The methods of mastication of Division I may be also defined by the terms of Div. II. Thus the proterotomes are all orthal, and I will show that the opisthotomes are also ectal. Some of the orthals are opisthotome, as the Tapiridæ.

The peculiarities of the Pantodont and Dinoceratous dentition may be now taken up in order, and their mechanical causes assigned so far as possible. *In limine* I take the position that the mastication of the Amblypoda was accomplished by the transverse movement of the lower jaw

across the upper, and that this is, therefore, the only order in which such mastication was performed by the primitive dentition, *i. e.*, the tritubercular and tuberculo-sectorial. That this is the type of mastication is suggested, but not proven, by the anisognathism of the dental system. But it is proven by the mark or path made by the posterior external cusp of the inferior true molar across the crown of the superior molar in the Coryphodontidæ. This cusp struck the posterior side of the rudimental anterior external lobe, and passed transversely across the crown (diagonally to the principal cross-crests), and slid up the apex of the internal cusp, producing the externally directed angle in its wear, seen in all specimens of the genera Metalophodon, Coryphodon and Ectacodon (Fig. 3). I also suspect that this movement is ectal, since the directions of the V's of the two dental series will permit no other. An at-

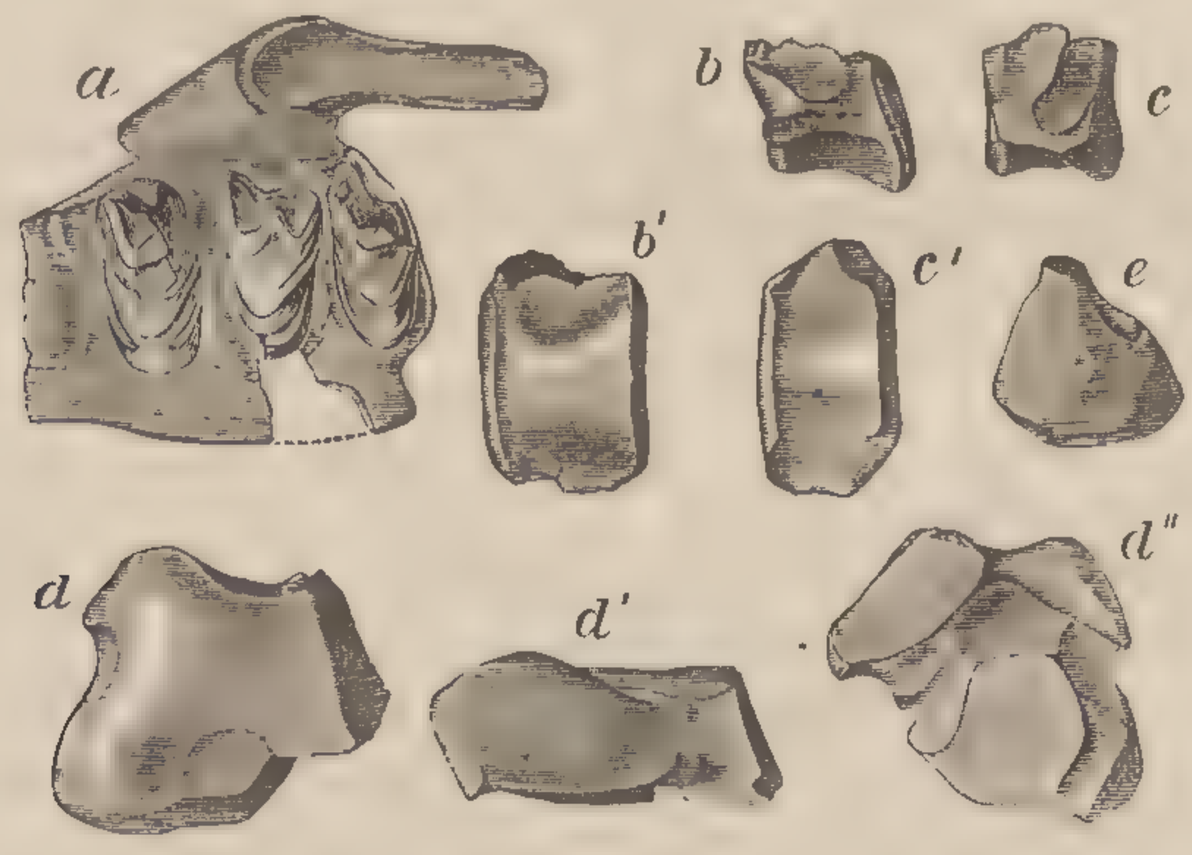

FIG. 1.—Bones and teeth of *Pantolambda bathmodon* Cope, two-thirds nat. size. From the Puerco beds of New Mexico. Fig. *a*, part of maxillary and malar bones from below, showing true molars, all somewhat broken. Figs. *b* and *c*, cervical vertebræ, left side; *b'* and *c'*, do. from below. Fig. *d*, astragalus from above; *d'*, from front, showing facet for cuboid; *d''*, from below; *e*, navicular bone from below. Original, from Report U. S. Geol. Surv. Terrs., F. V. Hayden.

tempt at an ental movement results in a jamming of the V's into each other, and further progress is impossible. It may be objected that the presence of the large superior canines forbids any considerable lateral movement of the lower jaw. The superior canines are however so divergent in the Coryphodontidæ that such movement is possible, and the transversely convex wear of these teeth proves just such a movement of the inferior canines on them. The lateral movement in the old males of the Dinocerata has been much restricted, but in younger males and females it was possible.

A second proposition is demonstrated by the discovery of the Pantolambdidæ. This is, that the superior molars of both the Coryphodontidæ and Uintatheriidæ are derived from a type with two external V's (Pantolambda, Fig. 1), and I propose to show how this derivation has been

accomplished, and under what mechanical necessity. Pantolambda also

FIG. 2.—*Pantolambda cavirictus* Cope, mandibular rami, two-thirds natural size. Fig. *a*, right ramus for outer side. Fig. *b*, left ramus from above. From the Puerco bed. Original, from Vol. iii, Report U. S. Geol. Survey Terrs., F. V. Hayden in charge.

shows that the inferior molar structure of the two types mentioned has been produced by modifications of a W-shaped type of crown. I note in passing, that the type of Pantolambda is itself readily derived from the primitive $\frac{\text{3-tubercular}}{\text{5-tubercular}}$ type of primitive placentals and marsupials.

With these propositions established, I proceed to consider first the origin of the dental peculiarities of the CORYPHODONTIDÆ.

First, no posterior inner tubercle was developed on the superior molars. We may regard this as a consequence of the fact that a transverse (ectal) movement of the lower jaw was established before the appearance of this cusp, instead of after it, as was the case in other ungulate orders, and because the shearing has been always from before backwards, instead of

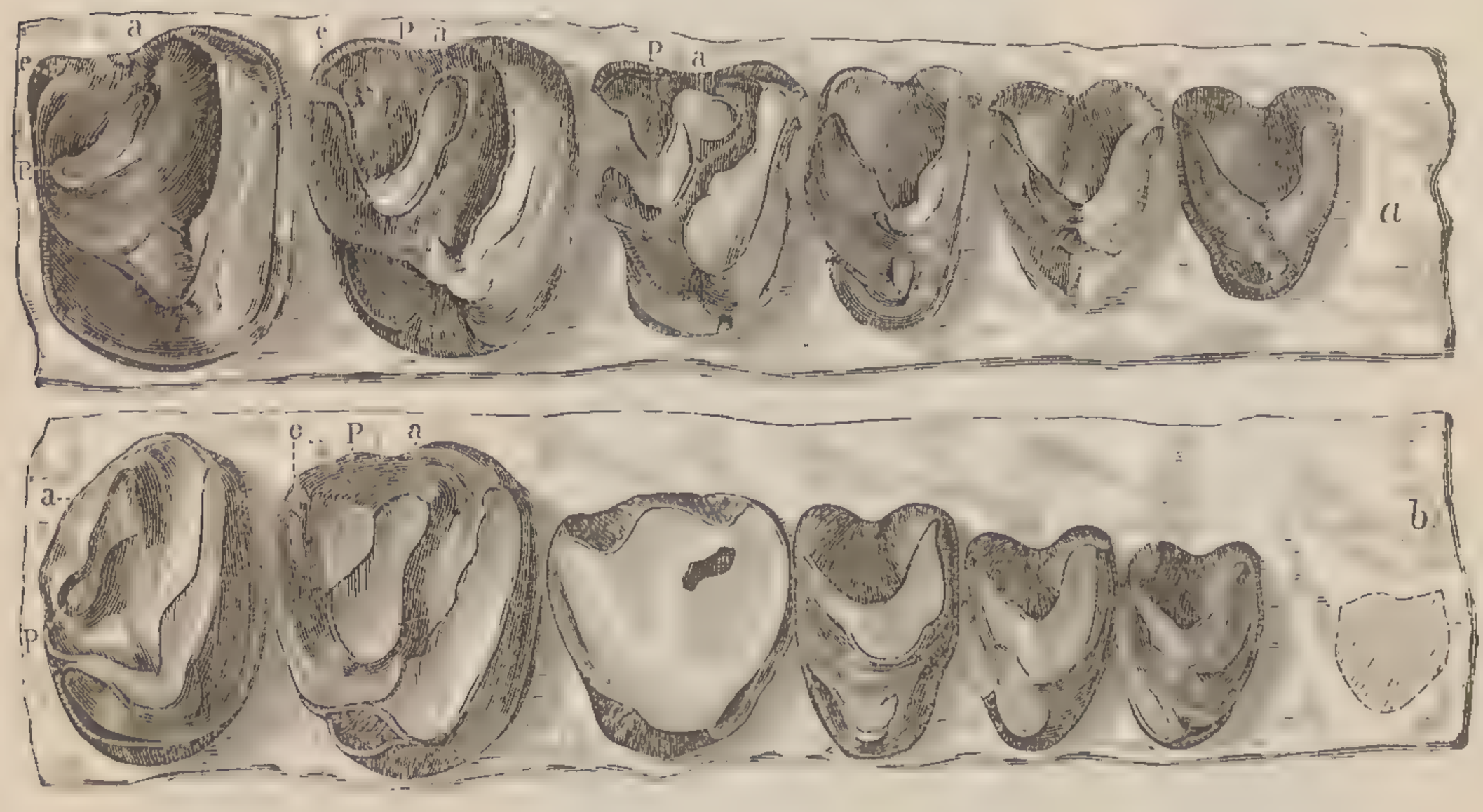

FIG. 3.—Superior molar series of Coryphodontidæ, two-thirds nat. size, from the Wasatch beds of Wyoming. Original. Fig. *a*, *Ectacodon cinctus* Cope. Fig. *b*, *Metalophodon testis* Cope.

overlapping from behind forwards, as in all other Ungulata. The stimulus already assigned as the cause of the development of the fourth tubercle is, under these circumstances, wanting. (Fig. 3.)

Second, the anterior cingulum, which extends from the internal cusp to the anterior external angle of the crown along its anterior base, is greatly developed. This may be reasonably ascribed to the stimulus produced by the friction of the posterior limb of the anterior V of the inferior molar in the transverse movement in mastication. The anterior crest of the superior molar is developed instead of the corresponding posterior crest of the superior molar in front of it, because the transverse movement of the

inferior molar follows a path much more nearly coinciding with the anterior crest of the superior molar than with the posterior crest. That is, it follows a curved path of which the centre is posterior, and near or between the glenoid cavities on which the mandibular rami move, as has been described by Ryder in various other ungulates.* This is the probable cause of the development of this crest from its originally moderate proportions in Pantolambda (Fig. 1), and from the unknown ancestor of that genus, where its dimensions are presumably still less considerable.

Third, the anterior external tubercle or V is reduced to a conical rudiment (Fig. 3 *a*). This is evidently due to the disuse following the great development of the anterior cingulum which extends from the internal tubercle to the anterior external angle of the crown. A similar but less considerable development of this ridge is accompanied by a corresponding reduction of the anterior external lobe, in some genera of the Lophiodontid Perissodactyla. The reason why this V has been extinguished and not merely pressed backwards, is the fact that the posterior external V of the superior molar has retained its place, and has not given way to allow room for the anterior one. This V has retained its place partly on account of its remoteness from the source of pressure in front, but principally because it fits the posterior transverse crest of the lower molar in front, and the anterior oblique crest of the next succeeding lower molar behind, so that its use has been only possible in its primitive position.

Fourth, the posterior limb of the posterior external V of the superior molar is wanting on the last molar in Coryphodon, and from the last two in Metalophodon (Fig. 3). The absence of this crest from the last superior molar is due to the absence of a corresponding crest of the inferior molar (Fig. 4). This is the oblique crest at the anterior extremity of the inferior molar, and it shears against the posterior limb of the posterior external V of the superior molar, representing the sectorial blade of Carnivora. It is little elevated in the Coryphodontidæ, owing to the fact that it is little used, since the crests of the inferior molars shear backwards and not forwards on those of the upper. The effect of this disuse tends, in the history of the Coryphodontidæ, to become more and more evident. The non-existence of a fourth molar behind the third in the lower jaw, accounts for the absence of the crest in question from the last superior molar, while the absence of the same crest from the second superior molar of Metalophodon, indicates the absence or rudimentary condition of the corresponding crest of the corresponding inferior molar.†

* Proceedings Philadelphia Academy, 1878, p. 56.

† I have just detected an error in Plate xlvi, Tertiary Vertebrata, which has been copied in *American Naturalist*, 1884, p. 1198, by which the artist has drawn the left ramus mandibuli of *Bathmodon radians* in the place of the right one. The two rami are in the specimen separate from the symphysis, and the artist has simply drawn the ramus in connection with the wrong branch of the symphysis. I had not noticed this egregious blunder until the present writing, and no one else appears to have observed it.

The above four propositions cover the principal peculiarities of the dentition of the Coryphodontidæ. I now proceed to a consideration of those of the UINTATHERIIDÆ.

FIG. 4.—*Coryphodon latidens* Cope, lower jaw, one-third natural size, from the Wasatch epoch of New Mexico. Fig. *a*, right ramus from internal side. Fig. *b*, both rami from above. Original, from Report U. S. G. G. Surveys W. of 100th Mer., G. M. Wheeler in charge. This specimen has an anomalous premolar.

As is well known, the crowns of the superior molars in this family support two cross-crests, which converge and nearly join at the internal extrem-

ity of the crown (Fig. 5). The anterior of these crests is pretty clearly the anterior cingular crest of Coryphodon, but the homology of the posterior crest is less obvious. In order to determine this point recourse must be had to the inferior molars, which are more readily understood.

FIG. 5.—Dinocerata teeth, one-fourth nat. size. Upper figures superior molars of *Uintatherium leidianum*, one-fourth nat. size. Lower figure, inferior molars of jaw of another species of Uintatherium. From Osborn, memoir on Uintatherium and Loxolophodon.

In the lower molar of the Uintatheriidæ, we find the anterior triangle of the tuberculo-sectorial type, but with the anterior limb rudimental. The posterior part of the crown differs from that of the Coryphodontidæ in having no posterior transverse crest, but in its stead the diagonal crest which connects the external extremity of the posterior transverse with the interior extremity of the anterior transverse crest. This oblique crest wears the posterior crest of the superior molars on its anterior face, as the anterior transverse crest wears the anterior crest (cingular) of the superior molar on its anterior face. (Fig. 6).

Comparison with the dental structure of Pantolambda (Fig. 1-2), shows which crests of the two series stand in this relation to each other. The diagonal crest of the inferior molar in this genus shears in front of the posterior limb of the anterior V of the superior molar. Guided by this fact we may regard the posterior cross-crest of the superior molar of the Uintatheriidæ, as the posterior limb of the anterior external V. We must then suppose that the anterior limb of this V has disappeared from this type of molar, and the anterior cingular crest has taken its place, thus forming a long V with the posterior limb. The tubercle between the crests at their open external valley, may be a remnant of this external crest. A low tubercle on the crown behind the inner extremity of the posterior crest, may be a rudimental fourth tubercle, or even the apex of the posterior external V.

The homology of the posterior crest of the superior molar here proposed is sustained by the fact that there is no posterior transverse crest on the lower molar.* Had the crest in question been part of the posterior V of the superior molar, the posterior crest of the inferior molar would have had use, and would not have disappeared.

If this homology is correct, the Dinocerata were derived directly from the Pantolambdidæ, and not through the Coryphodontidæ.

* The raised heel on these inferior molars is not the posterior transverse crest.

The mechanical causes of the peculiarities of the Dinoceratous dentitions are then the following :—

First, development of anterior cingular crest ; cause same as in Coryphodontidæ.

Second, loss of anterior limb of anterior external V of superior molars ; cause, disuse.

Third, shearing of oblique crest of inferior molar in front of instead of behind posterior limb of anterior external V of superior molar. Cause, development of anterior basal cingulum of superior molar, which wedges cross-crests of inferior molar anteriorly.

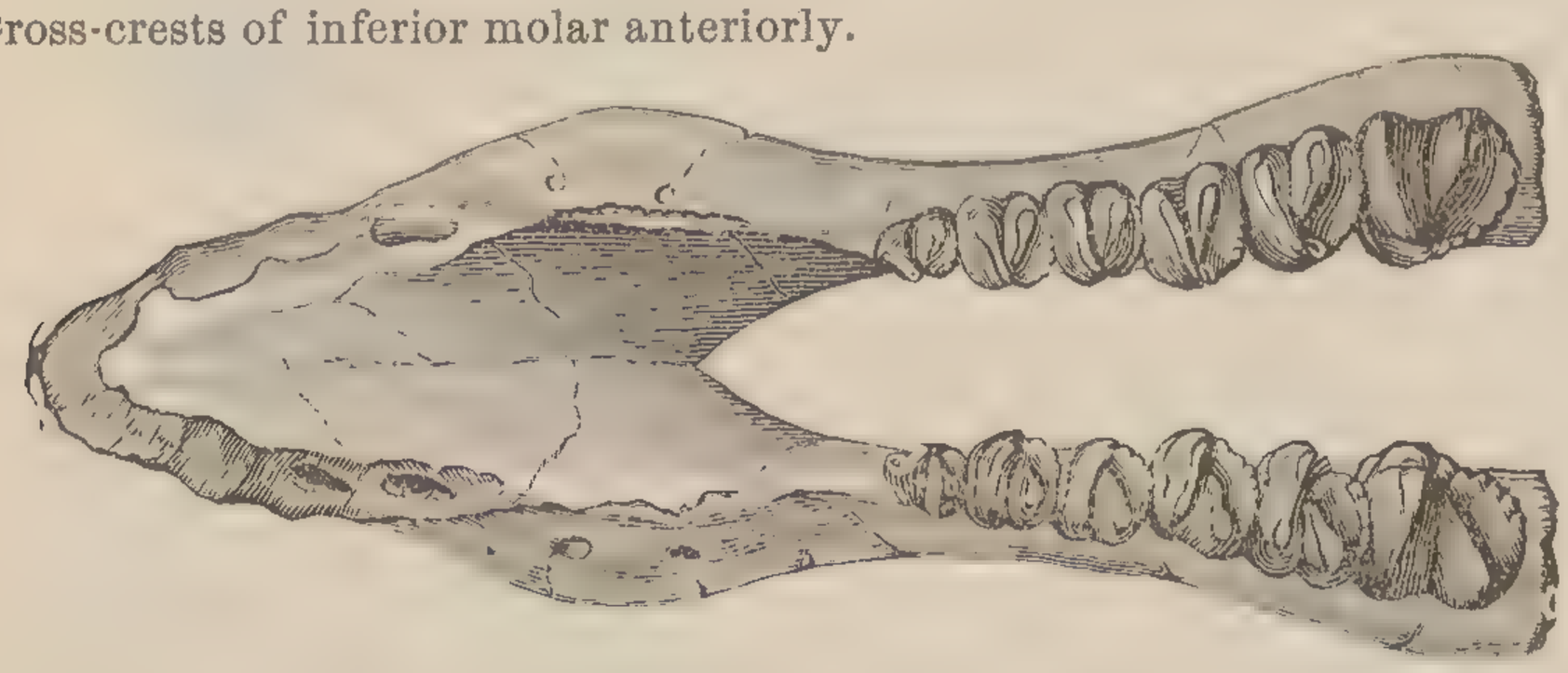

FIG. 6.—Uintatherium, mandible anterior to coronoid process, one-fourth nat. size; from Bridger beds of Wyoming. From Osborn, memoir on Loxolophodon and Uintatherium.

Fourth, loss of posterior cross-crests of inferior molars. The answer to this question is the answer to the other question, Why was the oblique crest of the inferior molar developed in the Uintatheriidæ while it remained rudimental in the Coryphodontidæ? The answer to these questions is the explanation of the principal peculiarities of the former family. The answer appears to me to be simply that while the movement of the lower jaw in mastication was probably ectal in the Coryphodontidæ, it was probably ental in Uintatheriidæ. This explanation is largely hypothetical, yet it accords with the relations between use and the development of the crests in the two families. In the ectal movement in Pantolambda the oblique crests of the opposing molars are soon separated from mutual contact, so that none of them have use on the internal half of the crown except the anterior cingular. In the ental movement, on the other hand, the limbs of the external V's are used to the utmost. The posterior limb of the anterior V is most used in Pantolambda, for the reason, as it appears to me, that the inferior molar is wedged forwards as it moves outwards in consequence of the guidance of the anterior cingular crest, and the wedge-shape of the triangular superior molar. While this causes the greatest use of the posterior limb of the anterior external V, it withdraws the posterior crest of the inferior molar from shear with the anterior crest of the posterior V, so that it has disappeared through disuse.

In general it may be observed, that the ental movement is the easier to the Dinocerata because the V's open exteriorly in both jaws. In the Pantodonta the ectal movement is easier, because the V's of the lower molars open interiorly.

The Glosso-pharyngeal Nerve in the Domestic Cat.

By T. B. Stowell, A.M., Ph.D.

(*Read before the American Philosophical Society, March 2, 1888.*)

Introduction.—The following study in comparative neurology is a continuation of the contributions made by the author and already published in the Proceedings of the Society. [The Vagus Nerve in the Domestic Cat (Felis domestica), read July 15, 1881 ; The Trigeminus Nerve in the Domestic Cat, read May 21, 1886 ; The Facial Nerve in the Domestic Cat, read Nov. 5, 1886.] The object of these contributions has been presented in the previous papers.

I am not aware that any one has published the detailed distribution and relations of this nerve ; this study is therefore offered as a contribution to comparative neurology.

Preparation.—As previously recommended, the cats were injected with the "starch injection mass." The dissections have been verified upon alcoholic and upon recent specimens ; the nerves have been traced under a magnifying power of 15–25 diameters. It is hoped that such a degree of accuracy has been attained as will render this study serviceable to students of the nervous system.

Description.

Synonymy.—Nervus glosso-pharyngeus, N. pharyngo-glossus, Glosso-pharyngeal nerve, Eighth pair of cranial nerves (Willis), Ninth pair (Sommering).

General Characters.—The N. glosso-pharyngeus is the cephalic member of a group of nerves whose ectal origin is along a line caudad of the eminentia auditoria and dorsad of the area elliptica. The common niduses in man from which the ental fibres of these nerves arise have been designated the "nuclei of the lateral mixed system" (28, p. 747).

The N. glosso-pharyngeus is characterized by the presence of two ganglia upon the central portion of the nerve-trunk, the central one (Fig. Ehr.) is within the foramen of exit (Fm. jugulare), the peripheral one (Fig. Pe.) is about 7 mm. peripherad of the foramen. The presence of the root ganglion and the ental origin ally this nerve and the dorsal roots of the myelic nerves.

The glosso-pharyngeus is specifically the sensory nerve of the pharynx, of the mucosa of the tympanum, and of the basal (circumvallate ?) papillæ of the tongue. It includes motor fibres which are given to the cephalic pharyngeal constrictor and to the stylo-pharyngeus muscles. Communicating rami connect the N. glosso-pharyngeus with the N. vagus, the N. sympathicus, the G. oticum, and with the N. facialis.

The glosso-pharyngeus is peculiarly the nerve of deglutition as well as the nerve of taste. The importance of having these functions associated

in the same nerve appears when the relation of food-stuffs to life is considered. The inverted muscular reaction which ensues upon the application of an unnatural or irritating stimulus is another characteristic of this nerve.

The conflicting evidence of Bell, Longet, Panizza, Reid, Mayo, Bernard, Chauveau, and other experimenters, leaves grave doubt as to the susceptibility of the N. glosso pharyngeus to receive painful impressions.

I am not aware that the function of the tonsillar branch has been demonstrated.

Ectal Origin.—The ental roots (5–6 funiculi) constitute a small nerve-trunk whose ectal origin is in the depression line dorsad of the oliva, the line of origin of the dorsal roots of the N. vagus [indeed, the cephalic funicle of the vagus seems to belong to the root funiculi of the glosso-pharyngeus]. The trunk so formed lies ventrad of the plexus choroideus lateralis and passes laterad to the foramen of exit.

Foramen of Exit.—The nerve takes its exit from the cranium through the foramen jugulare in connection with the vagus and the accessorius nerves, the jugular vein, and a small arteriole from the A. occipitalis.

Intercranial Course and Root Ganglion.—In the passage through the jugular fossa the sheath of the N. glosso-pharyngeus is distinct from and cephalad of the common sheath of the vagus and the accessorius and is separated by the arteriole above referred to. At the central end of the fossa the N. pharyngeus bears a small pinkish ganglion (G. ehrenritteri, G. nervi glosso-pharyngei superius, G. jugulare superius, G. mulleri). This ganglion lies upon the ectal surface and the ventral border of the G. jugulare of the N. vagus, but it does not appear to have structural relations with the ganglion. The ganglion (G. Ehr.) is ectal and does not involve all of the fibres of the trunk.

Plexus gangliformis, Pl. nodosus.—The central 5 mm. of the ectocranial trunk are closely apposed to, if not involved in the somewhat intricate net-work of vessels and tissues which characterize this region and form the gangliform or nodose plexus (Fig. Gang.). The apposed trunks of the glosso pharyngeus, the vagus, the accessorius, the hypoglossus, and the sympathic nerves by a peculiar interlacing of fibres and by anastomotic rami sustain intimate inter-relations. There is reason for thinking that through this plexus, the glosso-pharyngeus is connected with the accessorius (the complications involved in identifying rami in this plexus leave some doubt regarding the precise structure of this plexus). The glosso-pharyngeus is ectal in this group and is possibly separable from the ental nerves.

G. petrosum and its Communicating Rami.—At the caudal border of the plexus gangliformis the glosso-pharyngeus presents a fusiform enlargement, the ganglion petrosum (Fig. Pe.), ganglion of Andersch. This is the ganglion of the trunk and is about 2 mm. × 1 mm.; it seems to involve the entire nerve-trunk. Its communicating rami are five, as follows:

1. A large ramus to the dorso-cephalic border of the G. inferius of the N. vagus (Fig. 2). 2. A small ramus to the adjacent sympathic ganglion (G. cervicale cephalicum, Fig. 1). 3. A branch to the plexus, some fibres of which are apparently traceable to the N. accessorius, in the second or large accession from that nerve to the vagus (Fig. 3). 4. A slender filament (Fig. 4) to the auricular branch (Fig. Aur.) which joins the jugular ganglion of the vagus with the geniculate ganglion of the facialis. The auricular ramus crosses the ectal surface of the glosso-pharyngeus just peripherad of the G. ehrenritteri and receives the anastomotic filament from the G. petrosum at a point opposite the nerve-trunk (this filament is frequently broken in dissecting the plexus). These four rami are given off from the ental surface of the G. petrosum as a single trunk or as several closely apposed rami. 5. A large branch, the tympanic (Fig. Tym.) which lies in a fossa entad of the ectal bulla together with a branch from the sympathic. This branch divides in the fossa, into four ramuli, as follows: *a.* One (Fig. Pe. maj.) becomes one of the roots of the great superficial petrosal, which in turn is one of the roots of the vidian nerve. *b.* A second (Fig. Pe. min.) is one of the roots of the small superficial petrosal and terminates in the otic ganglion. *c.* A third (Fig. Eus.) forms a plexus around the eustachian tube. *d.* The fourth (Fig. Pl. tym.) forms, with the sympathic, the tympanic plexus upon the ectal surface of the promontory, from which filaments are traceable to the fenestra rotunda and the F. ovalis.

Principal Rami.—Peripherad of the G. petrosum the nerve-trunk bends around the ventral surface of the ectal bulla and lies apposed to an arteriole, a ramulus from the A. occipitalis. 8 mm. peripherad of the ganglion it gives the first ramus of the trunk (Fig. car.), caudad to the plexus carotideus about the ectal origin of the A. occipitalis. 6 mm. peripherad of this ramus, a branch is sent dorsi-mesad to the sphincter muscles of the pharynx (Fig. M. phar.)—this ramus seems to be the only distinctively muscular branch of this nerve; filaments are also given to the M. stylo-pharyngeus. It is through this ramus that the N. glosso-pharyngeus controls deglutition (the palatal branch, q. v., may possibly reach muscular fibre in the palatal region, corresponding to the M. palato-glossus, and the M. palato-pharyngeus. I have not satisfactorily identified these muscles).

N. pharyngeus.—At the origin of the muscular ramus just described a large ramus, N. pharyngeus (Fig. Phar.), is directed ventrad and caudad; this ramus, about 5 mm. peripherad of its origin, divides into two ramuli, the cephalic one (Fig. Pal.) is distributed to the pharynx in the palatal region; the caudal ramulus forms a dense plexus (Fig. Pl. Phar) with the pharyngeal branch of the vagus nerve (Fig. Phar. Vagus) upon the pharyngeal mucosa laterad of and adjacent to the epiglottis.

A second pharyngeal ramus (Fig. Phar. muc.) is given off 10 mm. peripherad of the first; this is distributed to the mucosa laterad of the base of the tongue. A third branch is given off about 5 mm. still peripherad, which unites in the pharyngeal plexus upon the mucosa.

N. tonsillaris.—About 10 mm. peripherad of the first R. pharyngeus a ramus (Fig. Ton.) is given to the tonsil and to its enveloping capsule. The function of this nerve is not known.

N. papillaris.—The terminal filaments (Fig. Papillæ) may be traced to the long papillæ (circumvallate ?) 15 mm. peripherad of the Os hyoides, upon the base of the tongue. These filaments are in the most restricted sense, the nerves of taste.

Summary.

A. Anatomical.

Ectal Origin.—By 5–6 funiculi in the depression line caudad of the eminentia auditoria, dorsad of the oliva and cephalad of the dorsal roots of the N. vagus.

Foramen of Exit.—Foramen jugulare.

Intercranial Course.—In the passage through the jugular fossa, the N. glosso-pharyngeus is the cephalic one of the structures which traverse the foramen. At the central end of the fossa, the nerve bears a ganglion, the G. ehrenritteri, which is ectal in position and does not involve the entire trunk.

Ectocranial Trunk.—The first 5–7 mm. of the ectocranial trunk are intimately associated with the plexus gangliformis which involves the central portions of the vagus, the accessorius, the hypoglossus, and the sympathic nerves, from which plexus it is generally distinct, although it contributes a considerable ramus (possibly this is an accession to the glosso-pharyngeus from the accessorius). 7 mm. peripherad of the foramen of exit the nerve is involved in a small fusiform ganglion.

G. petrosum and its Communicating Rami.—This fusiform ganglion involves the entire nerve-trunk; it is easily overlooked in the enveloping connective tissue and the adjacent plexus. From its ental surface a single trunk or four adjacent anastomotic rami take their ectal origins as follows: the ventral one to the cephalic cervical ganglion of the N. sympathicus; one just caudad and the largest joins the G. inferius of the vagus nerve; dorsad of this ramus the second in size is given to the plexus gangliformis, a portion of which seems to be traceable to the N. accessorius; the dorsal slender filament joins the ramus auricularis from the root ganglion, G. jugulare, of the vagus to the geniculate ganglion of the N. facialis. From the cephalic border of the ganglion the large tympanic branch, or Jacobson's nerve, lies in a fossa entad of the ectal bulla tympanica adjacent to a branch from the cervical sympathic ganglion. The tympanic nerve divides into four branches as follows: one of the roots of the great superficial petrosal nerve, the principal root of the small petrosal nerve which terminates in the otic ganglion, a slender filament which joins the eustachian plexus, and the branch to the tympanic plexus.

Principal Rami.

1. *Muscular;* a branch to the pharyngeal constrictor muscles (Fig. M. Phar.) has its ectal origin about 14 mm. peripherad of the G. petrosum.

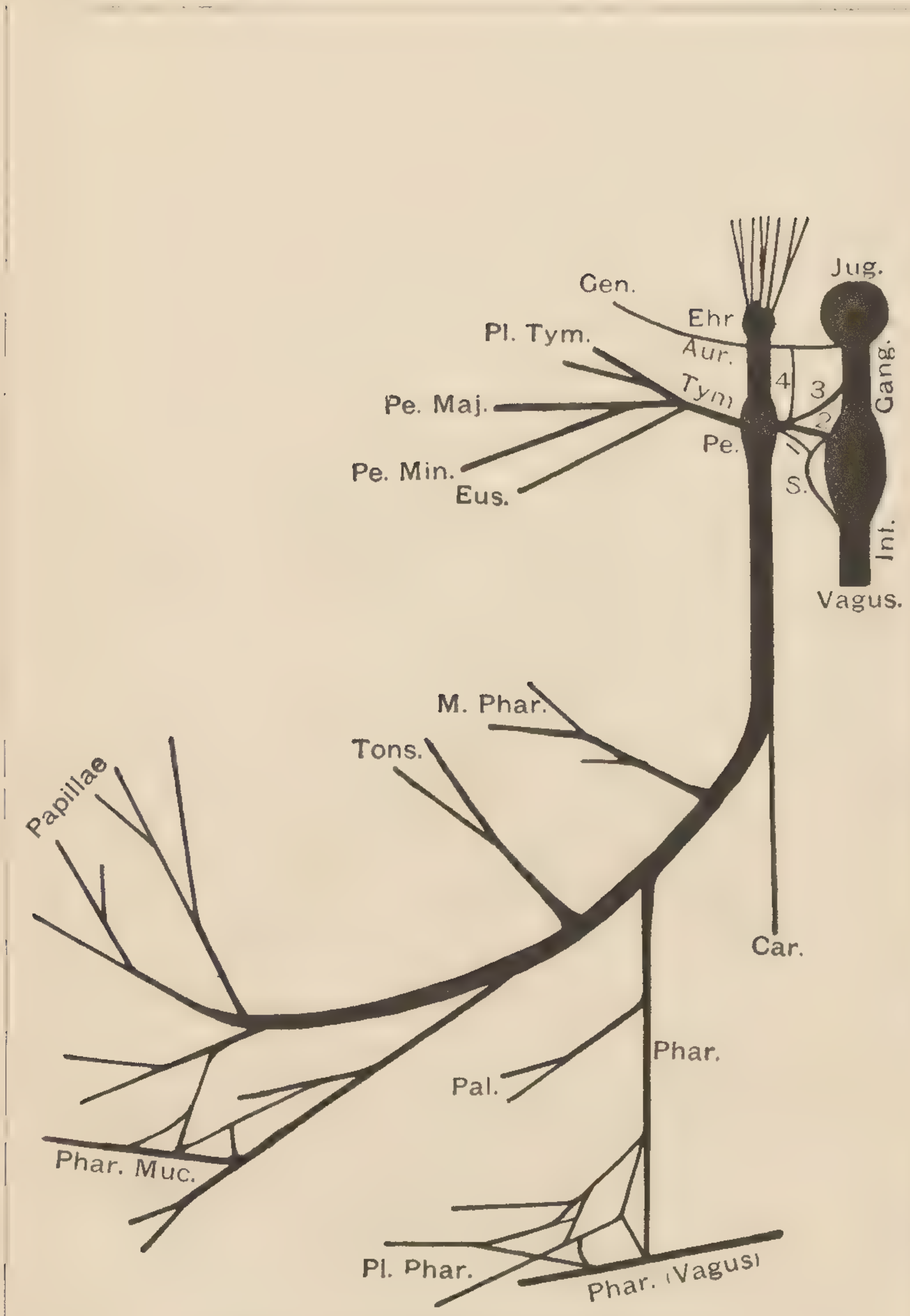

Diagram of the Glosso-pharyngeal Nerve.—Stowell.

2. *Pharyngeal;* three rami from the ventral border of the nerve-trunk to the pharyngeal mucosa.

3. *Tonsillar;* a branch, 10 mm. peripherad of the muscular ramus, to the tonsil and its enveloping capsule.

4. *Terminal;* to the long papillæ at the base of the tongue.

5. *Communicating and anastomotic;*

At the G. petrosum with the G. cervicale cephalicum (sympathicus).
" " " " G. inferius (vagus).
" " " " plexus gangliformis.
" " " " R. auricularis.
" " " it is the origin of the tympanic nerve (Jacobson).
To the plexus carotideus at origin of the A. occipitalis.
In the plexus pharyngeus with the N. pharyngeus (vagus).

B. Physiological.

The N. glosso-pharyngeus is the sensory nerve of the pharynx; it is the special sense nerve of taste; it controls deglutition, and when abnormally irritated excites an inverted muscular action in the muscles of the stomach and œsophagus, inducing vomiting; it does not seem to be susceptible of painful sensations.

Explanation of the Diagram.

The diagram is not drawn to a scale. It has been the author's aim to present in definite form the principal structures and relations, combining simplicity and clearness. Aur., the auricular branch from the jugular ganglion of the vagus nerve to the geniculate ganglion of the facial. This nerve crosses the ectal surface of the glosso-pharyngeus just ventrad of the root ganglion. Car., the anastomotic nerve to the carotid plexus around the ectal origin of the A. occipitalis. Ehr., the ganglion Ehrenritteri, or ganglion of the root. Eus., the branch which forms with the sympathic a plexus upon the eustachian tube. Gang., the plexus gangliformis, or plexus nodosus. Gen., the position of the geniculate ganglion of the facial nerve. Inf., the ganglion inferius or ganglion of the trunk of the vagus nerve. Jug., the ganglion jugulare or root ganglion of the vagus. M. phar., the muscular ramus to the pharyngeal constrictors. Pal., the branch of the pharyngeal nerve which is distributed to the mucosa in the region of the soft palate, and possibly to the palatal muscles. Papillæ, the terminal filaments of the papillary ramuli which are given to the long papillæ characteristic of the dorsal surface of the base of the tongue. Pe., the ganglion petrosum or ganglion of the trunk. Pe. maj., the branch of the tympanic nerve which becomes one of the roots of the great superficial nerve. Pe. min., the branch of the tympanic which becomes the small petrosal nerve and terminates in the otic ganglion. Phar., the pharyngeal ramus which joins the pharyngeal nerve from the vagus to form the pharyngeal plexus. Phar. muc., the rami which form the plexus over the pharyngeal mucosa. Phar. vagus,

the N. pharyngeus, a branch of the vagus. Pl. phar., the plexus pharyngeus. Pl. tym., the tympanic plexus over the promontory of the tympanum. S., the cephalic cervical ganglion of the sympathic ganglion, just entad and cephalad of the G. inferius. Ton., the tonsillar branch. Tym., the tympanic ramus or Jacobson's nerve. Vagus, the central 10 mm. of the vagus nerve, showing the relations of the ganglia. 1. Anastomotic filament from G. petrosum to S. 2. Communicating branch to the G. inferius. 3. Branch to the plexus gangliformis ; this is the doubtful accession from the N. accessorius. 4. Anastomotic filament to the R. auricularis.

Bibliography.

For bibliography consult previous papers. The Trigeminus Nerve in the Domestic Cat ; Proceedings of the American Philosophical Society, Vol. xxiii, pp. 459–478 ; 1886. Also, The Facial Nerve in the Domestic Cat ; Proceedings of the American Philosophical Society, Nov. 5, 1886.

The Accessory Nerve in the Domestic Cat.

By T. B. Stowell, A.M., Ph.D.

(*Read before the American Philosophical Society, March 2, 1888.*)

Synonymy.—N. accessorius ; Accessory of the Par Vagum ; Accessory nerve of Willis ; Spinal accessory ; Superior respiratory ; Eleventh pair of encephalic nerves.

General Characters.—This nerve is called accessory because of its large accessions to the N. vagus, in the G. jugulare and in the plexus just peripherad, v. description below ; it is called myelic and spinal from the fact of its widely distributed origin along the cervical myel, v. below. The nerve is an attractive study alike to the anatomist and to the physiologist ; its origin, distribution, terminal plexuses and its action upon respiratory movements, laryngeal phonation and the heart are equally distinctive. It combines a large group of myelic funiculi with a few from the medulla ; by virtue of its accessions to the Vagus it sustains structural relations with the N. pharyngeus and with the N. laryngeus caudalis (Rami of the Vagus), indeed a large share of the motor fibres of the Vagus is referable to the accessions from the Accessorius [Longet, Système Nerveux, t. ii, p. 265 ; Cl. Bernard, Leçons sur la Physiologie du Système Nerveux, t. ii, p. 244] ; by an anastomotic ramus it joins the N. hypoglossus, and in its terminal filaments it makes numerous plexuses with the cervical myelic nerves. M. Claude Bernard by his method of evulsion demonstrated that laryngeal phonation is due to the action of the accessory nerve. The prolonged cries of many mammals seem to confirm his conclusions and are due, in part, at least, to the rigidity of the cervical muscles in sustained expiratory movements. According to Heidenhain, this accession gives cardio-inhibitory fibres to the Vagus.

Description.

Ectal Origin and Entocranial Course.—The N. accessorius is peculiar in its two-fold origin, the medulla and the myel; the cephalic roots arise in the depression line dorsad of the area ovalis and immediately caudad of the dorsal roots of the N. vagus; the caudal roots arise along the lateral column of the cervical myel, as far caudad as the fifth cervical vertebra (fibres are not infrequently traceable along the entire cervical myel). The confluence of these funiculi forms a nerve trunk whose volume increases from its caudal origin to the foramen of exit. The nerve trunk thus constituted lies entad of the myelic dura opposed to the lateral column of the myel, between the dorsal and the ventral roots of the myelic nerves; its course is cephalad and enters the cranium through the foramen magnum; at the caudal border of the ectal roots of the N. vagus, the N. accessorius turns laterad and perforates the dura just caudad of the Vagus (I have not met with two entocranial trunks, as is sometimes the case in man), and takes its exit from the cranium through the foramen jugulare in the common sheath with the Vagus and the adjacent Glossopharyngeus.

Just centrad of the foramen of exit the Accessorius is closely opposed to the G. jugulare (Vagus), to which ganglion it gives a large ramus. This is the so-called accessory or motor root of the N. vagus.

Intercranial Relations and Foramen of Exit.—The N. accessorius traverses the jugular fossa, in which it lies caudad and laterad of the N. vagus, but apparently in a common sheath with that nerve (additional histological research may disclose a separate sheath for each nerve), and leaves the cranium by the foramen jugulare.

Ectocranial Trunk.—The first 5–10 mm. of the ectocranial trunk are involved in the dense plexus, Pl. gangliformis or Pl. nodosus (Fig. Plexus), with the Vagus. This plexus is formed by interlacing fibres of the Vagus, the Accessorius, a few fibres from the Hypoglossus, with numerous embracing and intertwining filaments of the N. sympathicus, and the vessels of this region; it is highly probable that the adjacent N. glossopharyngeus with its G. petrosum is involved in this plexus.

Peripherad of the plexus, the N. accessorius lies entad of the A. occipitalis and the V. jugularis (a ramule of the A. occipitalis is dorsi-laterad of the nerve in its ecto-cranial course as far as the A. occipitalis). At the caudal border of the A. occipitalis, the Accessorius bends dorsi-caudad, accompanied by a small arteriole and perforates the M. clavo-mastoideus near its dorsal border, 20–25 mm. caudad of the insertion of the muscle; this point is also dorsad of the cephalic end of the thyroid body.

Principal Rami.

N. clavo-mastoideus.—As the Accessorius perforates the M. clavo-mastoideus a large ramus (Fig. Clv.-Mas. ca.) is given to that muscle; it is accompanied by an arteriole, lies upon the ental surface of the muscle,

and may be traced to the caudad extremity (origin) of the muscle, where it is joined by the anastomosing filaments of the cervical nerves (Fig. Crv.). From the dorsal border of the nerve at nearly the same point a corresponding ramus (Fig. Clv.-Mas. ce.) is given to the cephalic end (insertion) of the same muscle; this ramus also innerves the adjacent cephalic extremity of the M. sterno-mastoideus (Fig. Str.-Mas.).

N. sterno-mastoideus.—Upon the ectal surface of the M. clavo-mastoideus a large ramus from the Accessorius enters the ental surface of the superposed sterno-mastoid muscle. *The shorter or dorsal division* of this ramus (Fig. Ster.-Mas. ce.) lies ectad of the trunk of the Accessorius and supplies the cephalic (insertion) third of the muscle, or that portion cephalad of the point of init of the nerve; *the ventral division* (Fig. Str.-Mas. ven.) is distributed to the thick ventral border of the caudal two-thirds of the same muscle. About 5 mm. peripherad, or at the dorsal border of the M. sterno-mastoideus, where the muscle is crossed by the large trunk of a cervical nerve (2°), a second ramus (Fig. Str.-Mas. dors.) is given from the Accessorius to the thin dorsal border of the caudal portion of the same muscle. This ramus lies ectad of the cervical nerve and receives from it a large accession. Since this muscle has two sources of nerve-supply, there is throughout the caudal portion of the muscle a more or less frequent anastomosis of terminal filaments.

N. clavo-trapezius cephalicus.—This ramus is given off in connection with the dorsal ramus of the N. sterno-mastoideus; it lies entad of an artery which supplies the cephalic 20 mm. of the M. clavo-trapezius. The nerve enters the ental surface of the ventral border of the muscle, with the artery just named, and sends a ramulus 5–10 mm. caudad of the artery and is distributed to the cephalic fourth of the muscle; the terminal filaments of the nerve may be traced to the dorsi-meson. Near its ectal origin this nerve receives an anastomotic branch from the second cervical nerve.

The main nerve trunk lies entad of the M. clavo-trapezius, crosses the ectal surface of the M. levator claviculæ and continues dorsad of the levator muscle upon the ectal surface of the M. splenius. At the ventral border of the M. clavo-trapezius the N. accessorius receives a large branch from the second cervical nerve which crosses its ectal surface in this region. At the dorsal border of the M. levator claviculæ it sends a slender ramus (Fig. Spl.) to the cephalic portion of the M. splenius.

N. clavo-trapezius caudalis.—About the middle of the M. clavo-trapezius, a large ramus, the N. clavo-trapezius caudalis, separates from the Accessorius and divides into three or four ramuli which enter the ental surface of the M. clavo-trapezius to be distributed to that portion of the muscle which lies dorsad of the M. levator claviculæ.

Between the clavo-trapezius and the acromio-trapezius muscles, upon the side of the neck, and dorsad of the levator muscle, is a narrow intermuscular interval, the *hiatus trapezii* (Fig. Hi.), filled with adipose, connective tissue, a large lymphatic, an artery, the accessory nerve and the cervical plexus of the second and third myelic nerves.

N. acromio-trapezius.—In this hiatus a large ramus (Fig. caudad of Hi.) is sent dorsad to the M. acromio-trapezius, which enters the cephalic border of the muscle and is distributed by 3–4 terminal ramuli to the dorsal portion of the muscle; caudad of the hiatus several (two shown in diagram) rami from the Accessorius enter the ental surface of the muscle.

Caudad of the hiatus (about 5 mm.) a large accession (Fig. Crv.) is received by the N. accessorius, from the cervical plexus. This nerve (myelic) accompanies the artery which appears in the hiatus.

The nerve trunk terminates upon the M. spino-trapezius. The tendon ectad of the *Delta mesoscapulæ* marks the caudal border of the acromio-trapezius muscle and the cephalic border of the spino-trapezius; entad of the ventral angle of this tendinous fascia is found the caudal continuation of the N. accessorius, now designated as the spino-trapezius nerve.

N. spino-trapezius.—At the cephalic border of the M. spino-trapezius, the accessory nerve divides into dorsal and ventral rami which may be traced throughout the muscle. Since the muscle is innerved by the thoracic nerves (myelic) as well as by the terminal rami of the Accessory, the terminal filaments of both nerves form an open plexus throughout its tissue.

Summary.

A. Anatomical.

Ectal Origin.—The N. accessorius arises from the lateral column of the cephalic myel and the caudal medulla dorsad of the area ovalis; the myelic roots are apparent as far caudad as the sixth or seventh cervical vertebra.

Entocranial Course.—The aggregation of these numerous roots forms a nerve-trunk which increases in volume from the caudal origin cephalad to the foramen of exit; the trunk is apposed to the lateral column of the myel, lies entad of the dura between the dorsal and the ventral roots of the myelic nerves, enters the cranium through the foramen magnum and extends cephalad in the cranium to the caudal roots of the N. vagus, where it perforates the dura and is associated with the vagus and the glosso-pharyngeus nerves in the foramen of exit.

Foramen of Exit.—The N. accessorius traverses the foramen jugulare with the associated vagus and accessorius nerves, the jugular vein and a small arteriole, a ramulus from the A. occipitalis.

Communicating Rami.

1. Accession to the G. jugulare (Vagus) centrad of the foramen of exit.
2. Several rami to the Plexus gangliformis, 5–10 mm. peripherad of the foramen jugulare (the first of these is the probable accession to the N. glosso-pharyngeus).
3. Accession to the G. inferius (Vagus).
4. With cervical nerves.

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Principal Rami—their Ectal Origins and Distributions.

N. clavo-mastoideus.

1. *Caudal ramus;* origin at the ental surface of the M. clavo-mastoideus as the nerve perforates the muscle.

2. *Cephalic ramus;* origin opposite the dorsal border of the muscle. These rami are distributed to the caudal and the cephalic portions of the muscle respectively.

N. sterno-mastoideus.

1. *Dorsi-cephalic ramus;* origin at the ectal surface of the M. clavo-mastoideus, distribution to the cephalic third of the muscle.

2. *Ventral ramus;* origin in common with the preceding, distribution to the thick ventral two-thirds of the muscle.

3. *Dorsi-caudal ramus;* origin at the dorsal border of the M. sterno-mastoideus in connection with the cephalic clavo-trapezius nerve, distribution to the thin dorsal border of the caudal two-thirds of the muscle.

N. clavo-trapezius.

1. *Cephalic ramus;* origin in common with the dorsi-caudal ramus of the sterno-mastoid nerve, distribution to the cephalic fourth of the M. clavo-trapezius; this nerve joins its platetrope in the dorsi-meson.

2. *Caudal ramus;* origin about the middle of the M. clavo-trapezius, distribution by 3–4 palmate ramuli to the ental surface of the caudal portion of the muscle.

N. acromio-trapezius.

1. *Cephalic ramus;* origin in the Hiatus trapezii, distribution to the cephalic portion of the acromio-trapezius muscle; this is the large nerve and extends to the dorsi-meson.

2. *Other rami;* several (two prominent) other rami supply the caudal portion of the muscle.

N. spino-trapezius.

The terminal rami of the Accessorius unite with the thoracic myelic nerves in an open plexus to the M. spino-trapezius.

Myelic Accessions.

Two large accessions from the myelic nerves are received by the trunk of the Accessorius, the *cephalic* is just caudad of the cephalic clavo-trapezius nerve, the *caudal* is just caudad of the hiatus-trapezii.

B. Physiological.

The N. accessorius is the motor nerve of the sterno-mastoid, the clavo-mastoid, and the trapezius muscles; it is possibly the source of the motor fibre of the Vagus nerve; it seems to be exclusively motor; its distribution and physiological experiments indicate the absence of sensibility; it is antagonistic to movements of respiration (Cl. Bernard); it controls laryngeal phonation (Cl. Bernard); it is cardio-inhibitory (Heidenhain).

Explanation of Diagram.

The diagram seeks to present the principal rami and relations of the nerve. Actual measurements and perspective are sacrificed to clearness

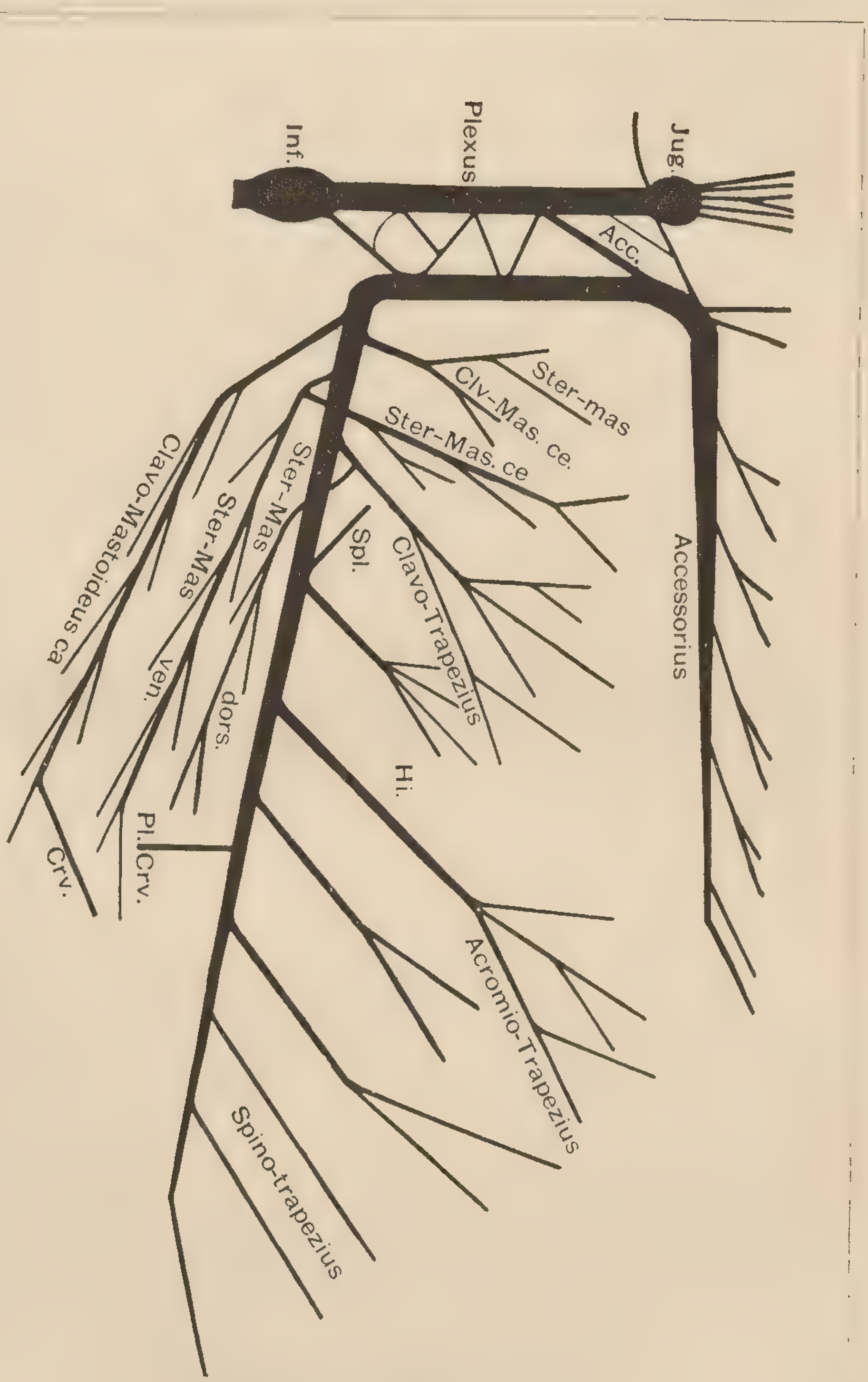

Diagram of the Accessory Nerve.—Stowell.

and simplicity, *e.g.*, the dorsal rami are laterad and the terminal filaments are dorsad of the line of origin, which relation is not shown.

Acc. Accessions from the N. accessorius to the N. vagus, etc. Acromio-trapezius, the three rami to the M. acromio-trapezius.

Clavo-mastoideus, ca., the caudal ramus of the clavo-mastoid nerve. Clv.-mas. ce., the cephalic ramus of the same. Clavo-trapezius, the two principal rami to the M. clavo-trapezius. Crv., cervical myelic nerve. Hi., the hiatus trapezii. Inf., the ganglion inferius. or ganglion of the trunk of the N. vagus. Jug., the G. jugulare of the same nerve. Plexus, the gangliform plexus of the Glosso-pharyngeus, the Vagus, the Accessorius, the Hypoglossus, and the Sympathic nerves. Pl. Crv., the cervical plexus from which the accession is given to the N. accessorius near the hiatus. Spino-trapezius, the rami given to the M. spino-trapezius. Spl., the branch to the M. splenius. Ster.-mas., ramus to the cephalic extremity of the M. sterno-mastoideus. Ster.-mas. ce., ramus to the same. Ster.-mas., dors., ramus to the dorsal border. Ster.-mas., ven., ramus to the ventral border of the same muscle.

Bibliography.

For bibliography consult the Trigeminus Nerve in the Domestic Cat. T. B. Stowell. Proceedings of the American Philosophical Society, Vol. xxiii, pp. 459–478, 1886. Also, The Facial Nerve in the Domestic Cat. T. B. Stowell. Proceedings of the American Philosophical Society, Nov. 5, 1886.

The Hypoglossal Nerve in the Domestic Cat. By T. B. Stowell, A.M., Ph.D.

(Read before the American Philosophical Society, March 2, 1888.)

The reasons for presenting this contribution to comparative neurology have been given elsewhere. (The Facial Nerve in the Domestic Cat. Proceedings of the American Philosophical Society, Nov., 1886.) The preparation of specimens and the magnifying powers used are described in the same paper.

Nervus hypoglossus.

Synonymy.—N. hypoglossus ; N. lingualis mediùs ; Par nonum ; N. loquens ; Hypoglossal nerve ; Gustatory nerve ; Ninth pair of nerves.

General Characters.—The N. hypoglossus is the motor nerve of the tongue and of muscles that move the hyoid bone. By virtue of its relation to the tongue it is directly concerned in mastication, since by the movements of the tongue successive morsels of food are thrust between the teeth or are moved preliminary to deglutition. Its function is further shown by those mammals whose food is largely liquid and is secured

by lapping, in which animals the prehension of food is impossible after section of the N. hypoglossus. Longet's experiments upon the entocranial trunk after section demonstrated the presence of excitability without sensibility; Mayo and Magendie proved the presence of sensibility in the ectocranial nerve. We are forced to accept a mixed function in this nerve or to attribute its sensibility to the accessions from the myelic nerves.

The section of the N. hypoglossus destroys movements of the tongue without disturbing the tactile or the gustatory sensibility [Longet, Anatomie et Physiologie du Système Nerveux, t. ii, p. 266].

The sensibility of the hypoglossus seems to be muscular rather than mucosal. Since the section of the N. vagus and the N. glosso-pharyngeus is attended by loss of sensibility over the entire surface or dorsum of the tongue, although the N. hypoglossus is intact. Panizza's experiments, confirmed by later observations, establish the paralysis of the pharyngeal muscles involved in deglutition by severing the N. hypoglossus. The vaso-motor function of the N. hypoglossus is seen in the dilatation of the vessels of the tongue when the nerve is severed; it is questionable whether the fibres to which this function is referable are not received from the myelic or the sympathic nerves.

The connection of the N. hypoglossus with distinct articulation is demonstrated by experiment and confirmed by pathological evidence. The prominent role in pronunciation performed by the tongue evinces the importance of this nerve in expressing thought by articulate language.

Description.

Ectal Origin and Entocranial Relations.—The N. hypoglossus has its ectal origin by several (12–16) funiculi along a depression line about 4 mm. laterad of the ventri-meson, and which marks the dorsal border of the caudal half of the area elliptica; these funiculi are grouped into two more or less distinct bundles which are separated by the first dorsal ramulus of the A. cerebellosa caudalis. The cephalic bundle embraces 8–12 funiculi (when the arteriole is represented by two vessels this cephalic bundle is again divided into two nearly equal portions); the caudal bundle includes about 6 funiculi, the caudal funiculus having its ectal origin at the cephalic border of the ventral root of the first cervical nerve, just entad of the A. cerebellosa.

The ectal origin resembles the ventral root of a myelic nerve.

Foramen of Exit.—The confluence of these funiculi forms a nerve trunk, which takes its exit by the foramen condylare.

Ectocranial Trunk.—The ectocranial course is immediately caudad, lies dorsad of the A. carotidea and entad of the V. jugularis as far as the A. occipitalis. The central 5–8 mm. of the ectocranial trunk are intimately involved in the gangliform plexus (Fig. Pl. gang.) which is made by the interlacing fibres of the associated glosso-pharyngeus, vagus, acces-

sorius, hypoglossus and sympathic nerves. Peripherad of the plexus the N. hypoglossus bends abruptly around the caudal border of the A. occipitalis (Fig. Ang.) and crosses the ectal surface of the N. vagus just cephalad of the G. inferius (vagus), also crosses the ectal surface of the A. carotidea and lies upon the ectal surface of the A. lingualis, which it crosses twice (the artery being the more sinuous), first about 8 mm. peripherad of the origin of the artery (A. lingualis), and again 10–12 mm. still peripherad. This portion of the trunk lies entad of the M. stylohyoideus, along the caudal border of the M. digastricus.

Communicating Rami of the Trunk.—At the angle (Fig. Ang.) a considerable accession is received from the first cervical nerve (myelic, Fig. Anas.); it is possible that this accession is the true origin of the cervico-hypoglossal nerve. (The minute anatomy of this region has not been satisfactorily determined.) Just cephalad of the G. inferius, and peripherad of the plexus a large ramus (Fig. Inf.) joins the ganglion at its dorso-cephalic border.

Principal Rami.

N. cervico-hypoglossus; N. cervicalis descendens; N. descendens noni.—At the angle (Fig. Ang.) where the accession is received from the myelic nerves, as the hypoglossus curves around the A. occipitalis, the N. cervico-hypoglossus takes its ectal origin. An anastomotic nerve joins the myelic nerve and this trunk (Fig. Anas.). The existence of this anastomosis makes it debatable whether the cervico-hypoglossus should be considered a ramus of the N. hypoglossus having a myelic accession, or a myelic nerve having a large accession from the N. hypoglossus. I have adopted the compound name applicable to either of the views cited.

The course of the nerve is ventro-caudad, and is at first entad of the jugular vein; it reaches the carotid artery about 7 mm. caudad of the A. occipitalis and continues caudad upon the ectal surface of the artery about 12 mm. to the origin of the A. thyroidea.

N. omo-hyoideus.—At the origin of the A. thyroidea, a large ramus is given off ventrad (Fig. Om-Hy. ce.). This ramus lies ectad of the artery and innerves the cephalic 25 mm. of the M. omo-hyoideus. The caudal portion of the muscle is innerved by a ramus of the N. cervico-hypoglossus which takes its ectal origin at the point where the nerve trunk touches the dorsal border of the M. sterno-thyroideus. This slender caudal ramus crosses the ectal surface of the sterno-thyroid muscle, enters its dorsal border and may be traced within the muscle to the præsternum* (Fig. Om-Hy. ca.).

N. sterno-thyroideus.—Caudad of the A. thyroidea the cervico-hypoglossus lies in the ental cervical fascia, ectad and ventrad of the A. carotidea.

* The origin of the M. omo-hyoideus is costal instead of scapular, as is the case in man; the general relations are such that little doubt can exist as to the homology of the muscle.

At a point opposite the cephalic extremity of the thyroid body, the nerve-trunk sends a slender ramus, the *cephalic* sterno-thyroid (Fig. St.-Thy. ce), to the cephalic third of the M. sterno-thyroideus : the *caudal* ramus (Fig. St.-Thy. ca.) is the caudal 50–60 mm. of the N. cervico-hypoglossus, and may be said to have its ectal origin at the origin of the ramus to the caudal portion of the M. omo-hyoideus or at the point where the nerve trunk lies upon the dorsal border of the sterno-thyroid muscle ; it follows the border of the muscle for about 20–30 mm., when it penetrates the muscle and terminates within the caudal extremities (origins) of the muscles (sterno-hyoid, omo-hyoid, sterno-thyroid), which have a common origin from the lateral border of the præsternum and the first costal cartilage.

Opposite the caudal extremity of the thyroid body the cervico-hypoglossal nerve is joined by a communicating ramus (Fig. communicans) from the adjacent cervical plexus or loop. This is the N. communicans noni. This branch does not seem to be constant.

N. thyro-hyoideus.—The ectal origin of this ramus is entad of the V. jugularis, immediately peripherad of the origin of the cervico-hypoglossal nerve ; its course is parallel to the latter nerve and ventrad of it ; it crosses the ectal surface of the A. carotidea at the origin of the A. laryngea cephalica, whence it bends ventrad and lies caudad of the artery and cephalad of the N. laryngeus internus ; it innerves the M. thyro hyoideus (Fig. Thy.-Hy.) and sends two terminal ramuli to the M. sterno-hyoideus, a *cephalic* ramulus to the cephalic portion, a *caudal* one to the caudal portion of the muscle. This nerve joins its platetrope in the ventri-meson.

N. stylo-glossus.—About 15 mm. ventrad of the A. carotidea the A. lingualis gives an arteriole to the M. stylo-glossus ; centrad of this arteriole the hypoglossus nerve sends a branch, the N. stylo-glossus, to the muscle having the same name. The nerve lies upon the ectal surface of the M. hyo-glossus ; at the ventral border of the stylo-glossus muscle it separates into a leash of terminal ramuli which intercommunicate by anastomotic filaments upon the muscle (Fig. Sty.-Gloss.).

N. hyo-glossus.—5 mm. peripherad of the last nerve the hyo-glossal nerve (sometimes 3–4 ramuli from a common trunk, or more frequently separate nerves) is given to the fibres of the M. hyo-glossus. The nerve crosses the ectal surface of the A. lingualis. The terminal filaments intercommunicate and form a loose plexus (Fig. hyoglossus) with the N. lingualis (R. of N. trigeminus), which in this region lies upon the ectal surface of the ranine artery.

N. genio-hyoideus.—At the dorsal border of the M. genio-hyoideus, the N. hypoglossus curves cephalad and follows the general direction of the genio-hyoid muscle, to which it gives from its ventral border the N. genio-hyoideus, which nerve may be traced 20 mm. cephalad in the muscle (Fig. Gen.-Hyoid).

N. genio-hyo-glossus.—Peripherad of the border of the M. genio-hyoideus, the N. hypoglossus bends mesad around the A. lingualis and lies entad of the artery. As it curves around the artery it gives from its ven-

tral border several filaments to the M. genio-hyo-glossus (Fig. Ge-hy-gl.); these filaments by their interlacing form a terminal plexus.

N. lingualis.—The hypoglossal nerve follows the artery along its ental border and supplies terminal filaments to distal 30 mm. of the tongue (Fig. Ter.).

Summary.

A. Anatomical.

Ectal Origin.—The nerve arises by 12–16 funiculi along a line 4 mm. laterad of the ventri-meson, which line marks the dorsal border of the caudal half of the area elliptica. The origin is nearly surrounded by arterioles from the A. cerebellosa.

Foramen of Exit.—Foramen condylare.

Principal Rami, their Origins and Distributions.

1. *N. cervico-hypo-glossus* (descendens noni); origin at the angle as the nerve bends around the A. occipitalis, distribution to the M. omo-hyoideus and to the M. sterno-thyroideus.
2. *N. thyro-hyoideus;* origin immediately peripherad of the last nerve, distribution to the M. thyro-hyoideus and to the M. sterno-hyoideus.
3. *N. stylo-glossus;* arises at a point 15 mm. ventrad of the A. carotidea, distribution to the M. stylo-glossus.
4. *N. hyo-glossus;* origin (2-3 rami) 5–10 mm. peripherad of the last nerve, distribution to the M. hyo-glossus; joins the N. lingualis in a plexus.
5. *N. genio-hyoideus;* origin at the dorsal border of the M. genio-hyoideus, to which muscle it is distributed.
6. *N. genio-hyo-glossus;* origin as the nerve trunk bends around the lingual artery.
7. *N. lingualis;* terminal filaments to the distal 30 mm. of the tongue.

Communicating Rami.

1. To the cervical sympathic ganglion.
2. To the N. vagus in the plexus gangliformis and in the G. inferius.
3. A large accession at the *angle* from the first myelic nerve.
4. The communicans noni to the N. cervico-hypoglossus.
5. With the N. lingualis (R. of N. trigeminus) in the terminal plexus.

B. Physiological.

The N. hypoglossus is the motor nerve of the tongue; it innerves several muscles which move the os hyoides; it is directly related to mastication and to deglutition; it is essential to distinct articulation; in function it is possibly a mixed nerve, the sensibility however is referred by some physiologists to the accessions from the myelic nerves; it possesses vasomotor fibres, which are possibly derived from the communicating rami.

Explanation of Diagram.

Anas., anastomotic ramus from first myelic nerve; this is the disputed origin of the N. cervico-hypoglossus. Ang., the angle where the N. hypoglossus bends around the A. occipitalis. Ca., caudal ramus. Ce., cephalic ramus. Communicans, a myelic accession, the communicans noni. Crv., myelic nerves. Gen-Hyoid, the genio-hyoid muscle. Ge-Hy-Gl., the genio-hyo-glossal muscle. Hyoglossus, the hyo-glossal muscle. Inf., the ramus to the G. inferius of the N. vagus. Lingualis, the lingual nerve of the mandibular division of the N. trigeminus. Om-Hy., the M. omo-hyoideus. Pl. car., anastomotic filament to the carotid plexus. Pl. gang., the plexus gangliformis. Sty-Gloss., the stylo-glossus muscle. St-Thy., the M. sterno-thyroideus. Thy-Hy., the M. thyro-hyoideus.

Aboriginal Pottery of the Middle Atlantic States.

By Francis Jordan, Jr.

(*Read before the American Philosophical Society, March 2, 1888.*)

In the whole range of archæology there are few subjects deserving of more thoughtful consideration, or that possess so many instructive and entertaining features as the study of ceramic art as practiced by primitive man. Its development is contemporary with the progress of civilization, and dates from the earliest period of antiquity, beginning with the manufacture of earthenware of the rudest description, exclusively for culinary purposes, from materials that were too obvious even for the semi-barbarian to overlook. The brief paper I have the pleasure of offering for your consideration is restricted to a discussion of but one of the many branches of this interesting study, namely, the characteristic features of the prehistoric pottery of the Middle Atlantic States, of North America, and the conditions under which it has been recovered.

In its fabrication as in all the departments of aboriginal domestic labor, the work was performed by women, who gave to these rude vessels whatever claim to artistic merit they possess, of which the relics of the mound-builders of the Mississippi valley furnish the best examples.

In form, in decoration, and in the use of pigments, and in their construction, these specimens rank with the early productions of the potters of the old world, a superiority that was doubtless the result of contact with the advanced civilization of the Pacific Coast, and a reproduction of its ceramic forms. The pottery of the Atlantic seaboard is more primitive in its character, and denotes, both in design and decoration, a more remote antiquity, a claim, however, that cannot be established if we accept Indian tradition as authority for the belief that the influx of emigration was from

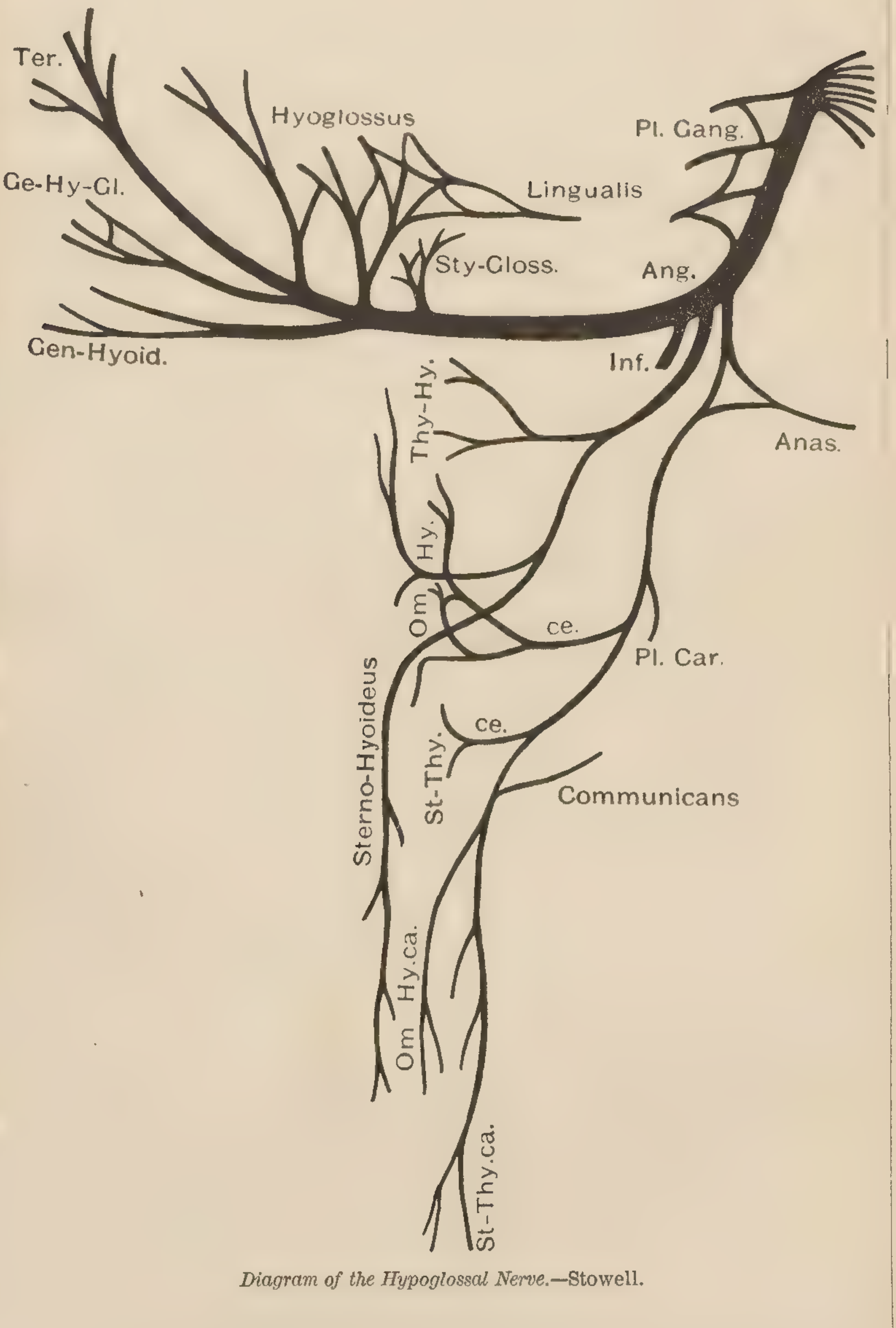

Diagram of the Hypoglossal Nerve.—Stowell.

the West. But it is hardly within the scope of this brief paper to enter into a discussion of the comparative ages of the pottery of the two sections. In view of the very limited number of perfect specimens which have their origin in the Middle Atlantic States, a thoroughly satisfactory treatise of the earthenware of that locality, omitting all other considerations, is hardly within the realm of possibility.

It may surprise those unacquainted with the data, to learn that the entire number of unbroken vessels will not exceed twenty-five, and of these the largest proportion, as well as the most remarkable, was found in Pennsylvania. On the other hand, many hundreds of the most valuable specimens have been recovered in perfect condition from the ancient earthworks and sepulchral mounds in the district beyond the Alleghanies. In some instances these tumuli are of vast proportions, but in the absence of sufficient evidence on which to form anything like an accurate opinion, their antiquity must remain a matter of conjecture. With their identity established, and with the knowledge that the American Indians, following a custom almost universal among semi-barbarous nations, deposited articles of earthenware with the dead, these ancient tombs may be explored without subjecting their contents to accidental destruction.

In the Middle Atlantic States, however, where this mode of sepulture rarely obtained, and where an Indian grave has no visible existence, its discovery is usually one of chance, and then almost invariably made by the plough, a medium very apt to efface all traces of its prehistoric character.

Incredible as it may appear, I am informed by Dr. Charles Rau that the National Museum, at Washington, within two years did not contain a single perfect specimen from the Eastern and Middle States in its archæological collection. In 1878 Prof. E. Hitchcock, of Amherst, Mass., sent to the National Museum colored plaster casts of three clay vessels found in New England. The most remarkable of them is figured in Vol. v, page 14, of the *American Naturalist.* This vessel, together with the largest of the three sent, is in the collection of the University of Vermont, at Burlington. The original of the third cast is in the possession of Mr. George Sheldon, Deerfield, Mass., who found it in the lot adjoining his home. "I know of but one other vessel of this nature," says Prof. Hitchcock, "ever found whole in New England. This is in the hands of Dr. S. A. Green, of Boston." The pottery of New Jersey possesses no distinctive features, if we are to be guided by the two or three unbroken vessels that have been uncovered within her borders. Dr. Abbott figures but one in his "Stone Age" of that State.

Delaware is even more disappointing, as she has thus far failed to contribute a single specimen to aid us in our comparative examination. On the banks of nearly all her water-courses are to be seen refuse shell deposits, many of them of considerable size, and all of great age, indicating a population more dense than any of her sister States. Mingled with the remains of these deserted villages are large quantities of broken pottery, but the fragments are those of coarse and generally undecorated pots that have

succumbed to hard usage, and in that condition consigned to the refuse heap. An unbroken specimen has never been found, and of the sherds, the largest that I have seen was the base of a pot unearthed near Felton, where I found it serving the purposes of a soap dish. Extreme plainness characterized the pottery of this State. In capacity they were scarcely more than quart pots, shaped like the gourd, with decorations of the simplest description, of which the most elaborate were those having incised parallel lines encircling the rim.

It is gratifying to be able to say that it has been reserved for Pennsylvania to furnish the best examples of this ancient industry. The Wyoming Historical and Geological Society, of Wilkesbarre, with commendable zeal, under the enthusiastic direction of the late Harrison Wright, succeeded in locating several Indian graves in Luzerne county, from which were exhumed nine very remarkable perfect specimens. These have been carefully described and figured in the Proceedings of that society, and hence it is only necessary to note the fact that although they were all found within a radius of twenty miles, there are no two identical in shape, and each has a different ornamentation.

Two more from the same State have been deposited in the museum of the Historical Society of Pennsylvania, very similar in form and decoration to those found near Wilkesbarre, which, with another discovered in the mountains near Summit Hill, constitute a distinct, and what I shall call the Pennsylvania variety, of which the high square decorated mouth is a prominent characteristic. These pots were made to contain from a half to one gallon, and are very much larger, as they are also the most beautiful of the mortuary pottery heretofore described.

In construction, design and decoration, very marked differences distinguish the specimens from the States under discussion, and in considering this part of the subject it is necessary to treat first the large undecorated vessels, evidently intended to withstand rough handling, of which the clay is thick—from a half to one inch—and the materials coarse. In appearance this class has a strong resemblance to our modern earthenware, but is heavier and apparently stronger, though actual test may disprove this latter quality. In the other grade we cannot fail to notice a delicacy of construction that pertains alone to the higher class of Indian pottery, upon which patient labor has been expended, producing a highly decorated and carefully finished vessel. Fine sand has been substituted for coarse clay, and the large particles of pounded shell or quartz, which are a conspicuous feature of the rude pots, have been eliminated: the whole showing a more careful preparation.

Of the designs in general it may be said that they occur in an almost endless variety, which in itself is a conceded merit, and one that the potters of the old world did not possess in a greater degree. The difficulties attending the execution of some of the forms is astonishing when we consider that they were made solely for purposes of utility. The prevailing shape was that of the gourd, and like it terminated in a

convex base, which required suspension when in use, for which ears projecting from the rim were provided; and where these did not exist the pot had to be supported when resting upon the earth. I am not aware of the existence of any vessel from this locality having a flat bottom.

In the rude and heavy vessels no deviation was made from the plain lines of the gourd, but in the finer examples the monotony of this form was relieved by flaring or contracting the lips, and in constructing double shoulders.

In some instances the inside, as well as the exterior, was colored a bright red, as if to conceal the inequalities of their rough surfaces, but there is no record of the discovery within the district under consideration of a pot ornamented with colored designs.

Nor are there specimens, so far as I can learn, from the Middle and New England States of bottle-shaped or long necked vases, so frequently met with among the mound relics, and in some sections of the South; and no attempt was made to imitate the human form, or that of birds and animals. The nearest approach thereto, as I have learned from Dr. Rau, are little grotesque human heads or masks stuck on the outside of the vessels below the corners of the rims. A number of fragments thus decorated, which were collected in the State of New York by Mr. F. H. Cushing, are in the National Museum at Washington.

When we consider the difficulties under which these ancient potters wrought their crude materials, the absence of mechanical appliances (unaided by the potter's wheel), their complete ignorance of the first rudiments of artistic knowledge, following only such lines as fancy dictated, we cannot but express amazement at the accura cy of the workmanship and the originality, if not the beauty, of the designs.

It was not the beauty of the trained Grecian or Etruscan schools, but the naturally developed taste of the aboriginee, who sought nature for her models, and found them in the gourd and melon.

Description of Datames magna Hancock. By Joseph L. Hancock.

(*Read before the American Philosophical Society, April 15, 1887.*)

Length 46 mm. (including mandibles); abdomen 24½ mm.; thorax 4 mm.; head 7 mm. Breadth, abdomen 9 mm.; head 10½ mm.; jaws 10½ mm.

Color pale reddish yellowish white, more reddish on head, falces and tips of last joints of legs; paler on abdomen, legs and labial palpi. Last joint (tarsus) of maxillary palpi and longitudinal marking under surface of tibia of the same member, deep brownish-black, fingers of mandibles burnished chestnut-brown, becoming black at points; margin of bristly hairs surrounding base of fingers, reddish-brown.

Cephalic Shield convexed, broader than long, anterior margin nearly straight, outer fourth sloping obliquely outwards and backwards to pos-

terior border, which is rounded ; corner eminences distinct, pale, obtuse, the front border on line with eyes ; shield covered with pale rather long reddish hairs, a bare pale border surrounding shield below, trace of median striæ hardly perceptible.

Eyes slightly elevated, small, front border on line with anterior margin of cephalic plate, encircled with black, pale color with black centre, interval equal to diameter of eye, furnished with hairs, some directed forward longer.

Base of Mandibles together not as broad as head, length of upper surface when closed 5 mm., furnished with numerous stiff reddish bristles of various length, becoming longer at base of fingers, fewer posteriorly, base slightly bulging on outer side, flattened on inner, where there are no hairs except on upper and anterior borders. Upper inner portion extended forward to form fixed finger, 6½ mm. in length, bent slightly outward at base, directed obliquely downward and slightly outward, anterior three-fourths straight, smooth, tapering to point, unarmed, slightly grooved on inner side, which is covered with a brush of long reddish bristly hairs attached to inner side near base, directed forwards, nearly reaching to points. Below the fixed finger is a conical projection armed in front with two rows of teeth, as in figure ; on outer side from above downwards five, first and fifth denticles, second, third and fourth larger and more acute. The second projecting further forward, traces of more points visible continued down on outer margin, teeth covered externally with fringe of reddish hairs. On inner side, largest tooth above projecting fartherest forward than a smaller one, after which follows two small ones with space between, trace of points on inner margin below, teeth tipped with black.

Movable Finger 7 mm., with large acute conical tooth near the base (as in figure), concave behind, convexed in front with point directed upwards and backwards, lying close on inner side is another small conical tooth with point turned more inward and forward, more anteriorly is a small denticle, trace of one midway between. Median carina extending on outer side nearly to point, lower finger set slightly posterior to upper, strongly curved, when closed points pass internal to upper pair, 1 mm. from points, motion vertical, directed from below, inwards, forwards, and slightly outwards, constricted at points, inner side covered with numerous fine feathery hairs continuous with fringe of reddish bristly hairs along inner front margin of base.

Maxillæ directed outwards, upwards and forwards, first joint immovable, bulging, triangular, separated from its fellow on opposite side by deep groove. Elongated on inner margin into a blunt pointed apophysis, surface covered with short pale hairs, second joint short, triangular, with rounded base directed forward, third joint (femur) length 11 mm., longest of maxillary joints, fourth (tibia) 10 mm., fifth (tarsus) 8 mm., length entire 34 mm., femur cylindrical, first half flattened from side to side, enlarged toward extremity. Inner surface of shaft with row of reddish spines of various lengths, increasing in length toward outer end. Tibia more perfectly cylindrical, slightly enlarging toward

extremity, four or five reddish spines forming row on inner portion of shaft, under surface of shaft presenting a longitudinal line of dark brownish-black, becoming wide at extremity; femur and tibia covered with pale yellow hairs, some exceedingly long; tarsus cylindrical becoming slightly swollen at end, color deep brownish-black, thickly set with hairs, some delicate and long, on the under surface very short stumpy hairs appear, extremity furnished with retractile organ covered with a double lip.

Labial Palpus. The first joint of the labial palpus is subcylindrical, nearly as long as first joint of maxilla, to which it is closely adherent, 4½ mm. in length, second joint short cylindrical, trapezoidal in form, third joint same length as second, rhomboidal in form, first three joints together 8 mm., fourth joint more slender, slightly bent, 6 mm., fifth joint 7 mm., sixth joint straight and thinner, 4 mm., seventh joint still thinner and shorter, 3 mm. Anterior surface of first joint clothed with short stiff bristles of reddish color, rest of surface covered with fine pale hairs, as compared to the maxillæ the labial palpi are very slender, shorter by 8 mm. Covered with abundant hairs, some of extreme thinness and silky, quite long.

Thorax small and weak, first segment attached to head closely, pale reddish hairs radiate from this juncture, other two segments appear continuous with abdomen but of shorter diameter, on either side and at point of attachment with head are whitish folds of skin. Each segment sparsely covered with pale hairs. The under surface presents three pairs of basal joints, which are immovable, first pair separated by deep groove from basal plate of labial palpi, separated from each other by a slight median groove, second and third pairs of basal joints closer together, divided from first pair by a deep transverse groove, first pair directed transversely across, second pair inclining obliquely backwards, third pair trifle more obliquely backwards, triangular space left between last pair connecting with abdomen pale whitish.

Legs. First pair of legs 23 mm., shortest stout, first joint short, fixed, quadrangular in outline, rounded, separated by a median indentation from its fellow on opposite side, clothed with short broken-off bristles on anterior surface, second joint same length, subtriangular, short reddish bristly hairs on under surface, third joint longer than second, trapezoidal, bending upwards, fourth joint (femur) longer than third, more cylindrical, bending upwards, fifth joint (tibia) longer and thinner, bends downwards, sixth joint (metatarsus) shorter and weaker than tibia, bends downwards, tarsus one-third as long as metatarsus, two curved palish white claws articulate at extremity, sharp at points which appear red and constricted. Second pair of legs like the first with additional joint wedged in between second and third joints, length 29½ mm. Metatarsus of first feet with row of five short red spines on dorsal surface, one more on outer extremity of tibia which forms a continuous line with the preceding ones, also an imperfect row, three in number on inner side of metatarsus. Metatarsus of second feet with five reddish spines on dorsal surface, continuous with two

at extremity of tibia. Third pair of legs 42 mm., longest. Appendages on under surface pale whitish, of a horny consistence, fan-shaped and attached by foot stalks, ten in number, five on each side, two being adherent to each of the first two, another to each of the third joints, first joint fixed, subtriangular, with base directed obliquely backwards and outwards, equal in length to first pair of basal joints, second joint longer than the basal joint, third joint half the length of the second, fourth joint slightly longer than the third, swollen on under surface changing the direction of the leg slightly backwards, motion being confined to upward movement by first three joints (exclusive of the basal joint), fifth joint (femur) cylindrical and swollen, 10 mm., sixth joint (tibia) more slender, same length, cylindrical, seventh joint (metatarsus) 7 mm. more slender, eighth joint (tarsus) 3½ mm., armed at extremity with two pale-colored claws, regularly curved, with sharp constricted points of red color.

Abdomen. Composed of ten segments increasing in size to middle segments which are 3½ mm. long and 9 mm. wide, slightly decreasing in size posteriorly, first joint bears the genital opening on the under surface which is enclosed by an elevated plate of pale whitish horny substance, orifice triangular, apex directed forward, which is continued into a longitudinal slit, free from hairs, second and third segment each have on middle of posterior border stigmatic openings. The abdomen as a whole is oblong, oval, elliptic in form, convexed about equally above and below, slightly compressed, pale yellowish-white, clothed with velvet of pale whitish hairs on both sides and under parts ; trace of broad longitudinal band on upper surface, more naked, beset with pale whitish hairs, band becoming narrower posteriorly, being 6 mm. wide at second joint ; under surface of abdomen slightly depressed by a median line, ventral opening a vertical slit 2 mm. in length on last segment, protected on both sides by narrow lips.

Habitat, Laredo, Texas ; taken in 1883.

EXPLANATION OF PLATE.

A. *Datames magna* Hancock, upper surface.
B. Same, under surface.

The following are magnified views :

a. Side view of mandible showing finger and teeth.
b. Front view of mandible showing position of secondary teeth, right side.
c. Maxillary palpus, left side, under surface, showing spines.
d. Labial palpus, left side, under surface.
e. Last three joints of third leg.
f. Last three joints of second leg, showing spines on dorsal surface of metatarsus and tibia.
g. Last three joints of first leg showing spines on dorsal and inner surface of metatarsus and tibia.
h. General appearance of claws under higher power of microscope.

c
d
e
f
g
a
b
A
B
h

Stated Meeting, January 20, 1888.

Present, 24 members.

Vice-President, Dr. RUSCHENBERGER, in the Chair.

Correspondence was submitted as follows, viz.: A letter from Col. R. Somers Hayes, New York City, N. Y., acknowledging his election to membership.

A letter from Dr. Aristides Brezina, Vienna, acknowledging receipt of his diploma and of Proceedings, Nos. 121, 122, 123, 124, and 125.

Acknowledgments for Proceedings, No. 125, from the Observatory at Tashkend, Russia; Zoölogical Society, Amsterdam; R. Accademia dei Lincei and Prof. G. Sergi, Rome; Essex Institute, Salem, Mass.; Profs. L. M. Haupt, John M. Maisch, James Tyson, Joseph Leidy, G. I. Riché, and Messrs. F. Graff, Philadelphia, and the University of Michigan, Ann Arbor; Colorado Scientific Society, Denver.

Acknowledgments for 403 packages for foreign transmission from the Smithsonian Institution.

A letter of envoy from the Bureau of Ethnology, Washington, D. C.

Accessions to the library were received from the Minister of Mines, Wellington; Mining Department, Melbourne; Gesellschaft für Anthropologie, etc., Messrs. Friedländer & Son, Berlin; Geographische Gesellschaft, München; Publishers of "Der Naturforscher," Tübingen; Prof. E. Renevier, Lausanne; Institution Ethnographique, Société de Geographie, Mon. Victor Duruy, Paris; R. Academia de la Historia, Madrid; Sociedade de Geographia de Lisboa; Society of Arts, London; Royal Geographical Society of Ireland, Dublin; Mr. A. F. Chamberlain, Toronto; Historical Society, New York; Franklin Institute, Mr. Henry Phillips, Jr., Dr. Ruschenberger, Philadelphia; Second Geological Survey of Penna., Harrisburg; Johns Hopkins University, Baltimore; U. S. Geological Survey, Bureau of Education, U. S. National Museum, Bureau of Ethnology, Hydrographic Office, Mr. C. F. Neill, Washington, D.C.; Prof.

C. L. Herrick, Granville, O.; Kansas Academy of Science, Topeka; University of California, Sacramento.

A photograph was presented for the Society's album by Dr. Aristides Brezina, Vienna.

A letter was read from the University of Bologna, inviting the Society to be represented at its ensuing eight hundredth anniversary, and on motion the President was authorized to appoint at his leisure a suitable person or persons for that purpose. (Subsequently the President appointed Messrs. Giovanni Capellini, of Bologna, and Henry Phillips, Jr., of Philadelphia.)

A circular was read from the Elizabeth Thompson Science Fund announcing that its funds were available for scientific work, and that applications for the same should be sent to Dr. C. S. Minot, Boston, Mass.

A letter was read from Henry Uhlke, Washington, D. C., offering for $200 a portrait of the late Spencer F. Baird. On motion, the President was authorized to appoint a committee of three to examine into the matter referred to, and to report to the Society.

A letter was read from Miss Marie A. Brown, Boston, Mass., enclosing a memorial to Congress in reference to a proposed Viking Exhibition.

A letter was read from the Iowa State University, Iowa City, requesting the Proceedings of the Society, and, on motion, it was ordered to receive the same from No. 96 and the catalog of the Society's library.

A prospectus of the American Folk-lore Society was read, and, on motion, the Society subscribed to the journal.

An obituary notice of Ferdinand V. Hayden, by Prof. Lesley, was read by the Secretaries.

The stated business of the meeting was then taken up, and the election for Librarian being in order, Mr. Henry Phillips, Jr., was unanimously reëlected Librarian for the ensuing year.

On motion, the President was authorized to appoint at his leisure the Standing Committees of the Society, which he subsequently appointed, as follows:—

Finance.—Henry Winsor, J. Price Wetherill, William B. Rogers.

Hall.—J. Sergeant Price, William A. Ingham, Charles A. Oliver.

Publication.—Daniel G. Brinton, George H. Horn, Persifor Frazer, Samuel Wagner, Patterson Du Bois.

Library.—Edwin J. Houston, William V. McKean, William John Potts, Jesse Y. Burk, William H. Greene.

Prof. Cope presented the following papers for the Transactions:—

I. The characteristics of the Vertebrate Fauna of the Puerco Epoch of North America.

II. Lemurine Reversion in Human Dentition.

III. The Shoulder, Girdle and Limbs of the Eryops.

The President was authorized to appoint at his leisure the usual committees to examine these papers. (Profs. Heilprin, Ryder and Lewis were subsequently appointed.)

Nominations Nos. 1173, 1174, and 1175 were read.

And the Society was adjourned by the presiding member.

Stated Meeting, February 3, 1888.

Present, 14 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:—

Envoys: From the Mining Department, Melbourne; Smithsonian Institution, Bureau of Ethnology, Washington, D. C.; Prof. Antonio Peñafiel, Mexico.

Acknowledgments: Harvard College, Cambridge, Mass. (Transactions [N. S.], Vols. I–XV, XVI, 1); State University of Iowa, Iowa City (Procs. 96–126, etc.); State Historical Society of Wisconsin, Madison (Catalogue, Parts 1–4, inclusive).

Acknowledgments for Proceedings, No. 126, were received from Mr. Horatio Hale, Clinton, Ontario; Sir John William Dawson, Montreal; Geological and Natural History Survey of Canada, Ottawa; Toronto University, Canadian Institute, Dr. Daniel Wilson, Toronto; Historical and Scientific Society,

Winnipeg; Society of Natural History, Portland; N. H. Historical Society, Concord; American Academy of Arts and Sciences, American Statistical Association, Boston Society of Natural History, State Library of Mass., Dr. Oliver W. Holmes, Hon. Robert C. Winthrop, Boston; Museum of Comparative Zoölogy, Profs. A. Agassiz, Joseph Lovering, Mr. Robert N. Toppan, Cambridge; Essex Institute, Salem; Free Public Library, New Bedford; Dr. Pliny Earle, Northampton; Brown University, Rhode Island Historical Society, Rhode Island Society for the Encouragement of Domestic Industry, Prof. Thos. Chase, Providence; Connecticut Historical Society, Hartford; Yale College Library, Profs. Elias Loomis, H. A. Newton, New Haven; Prof. James Hall, Albany; Prof. W. LeConte Stevens, Brooklyn; Society of Natural Sciences, Buffalo; Prof. B. G. Wilder, Ithaca; Astor Library, New York Academy of Medicine, New York Academy of Sciences, New York Historical Society, New York Hospital, University of the City of New York, Drs. J. S. Newberry, J. J. Stevenson, J. A. Allen, Mr. John Ericsson, New York City; Vassar Brothers' Institute, Poughkeepsie; U. S. Military Academy, West Point; Prof. H. M. Baird, Yonkers; Rev. J. F. Garrison, Camden; Prof. George H. Cook, New Brunswick; Prof. W. H. Green, Princeton; Dr. C. B. Dudley, Altoona; Dr. R. H. Alison, Ardmore; Rev. J. A. Murray, Carlisle; Prof. Martin H. Boyé, Coopersburg; Profs. Traill Green, T. C. Porter, Easton; Mr. Andrew S. McCreath, Harrisburg; Profs. L. B. Hall, Isaac Sharpless, J. C. Booth, Haverford; Mr. John Fulton, Johnstown; Linnean Society, Lancaster; Messrs. P. W. Sheafer, Heber S. Thompson, Pottsville; Philosophical Society, Messrs. Edwin A. Barber, William Butler, Philip P. Sharples, Washington Townsend, West Chester; Wyoming Historical and Geological Society, Wilkes-Barre; The Athenæum, College of Physicians, Franklin Institute, Library Company of Philadelphia, Numismatic and Antiquarian Society, University of Pennsylvania, Wagner Free Institute, Zoölogical Society, Messrs. George W. Anderson, John Ashhurst, Jr., Cadwalader Biddle, George D. Boardman, J. H. Brinton, Isaac Burk, Thomas M. Cleeman, Patterson DuBois,

F. A. Genth, Jr., Frederick Graff, George Harding, Henry Hartshorne, H. V. Hilprecht, Edwin J. Houston, William A. Ingham, Francis Jordan, Jr., W. W. Keene, Joseph Leidy, F. W. Lewis, H. Carvil Lewis, John M. Maisch, E. Y. McCauley, F. A. Muhlenberg, Isaac Norris, Jr., Charles A. Oliver, C. Stuart Patterson, Robert Patterson, Henry Phillips, Jr., Franklin Platt, Theo. D. Rand, George J. Riché, Geo. B. Roberts, W. S. W. Ruschenberger, Oswald Seidensticker, Coleman Sellers, Aubrey H. Smith, George Stuart, W. P. Tatham, H. C. Trumbull, James Tyson, William H. Wahl, Henry Winsor, Henry D. Wireman, Ellis Yarnall, Joseph Zentmayer, Philadelphia; Wm. H. Canby, Wilmington, Del.; U. S. Naval Institute, Annapolis; Maryland Historical Society, Maryland Institute, Prof. Ira Remsen, Baltimore; U. S. Geological Survey, Patent Office, U.S. Naval Observatory, Surgeon-General's Office, Library of Congress, Signal Office, Messrs. J. H. C. Coffin, Thos. J. Lee, Wm. Ludlow, Garrick Mallery, Chas. A. Schott, William Strong, Wm. B. Taylor, Washington, D. C.; Virginia Historical Society, Richmond; Library of the University of Virginia, Prof. John W. Mallett, University of Virginia; Elliott Society of Science and Art, Charleston; University of South Carolina, Columbia; Georgia Historical Society, Savannah; Cincinnati Society of Natural History, Cincinnati Observatory; Dr. Leo Lesquereux, Columbus; Rev. Henry S. Osborn, Oxford, O.; Dr. Robert Peter, Lexington, Ky.; Prof. Daniel Kirkwood, Bloomington; University of Illinois, Champaign; Rantoul Literary Society; University of Michigan, Profs. Henry S. Frieze, Alex. Winchell, Ann Arbor; Davenport Academy of Natural Sciences; State Historical Society of Wisconsin, Madison; Colorado Scientific Society, Denver; University of California, Prof. John L. LeConte, Berkeley.

Accessions to the Library were announced from the Mining Department, Melbourne; Physiologische Gesellschaft, Deutsche Geologische Gesellschaft, Berlin; Académie R. des Sciences, etc., de Belgique, Bruxelles; Biblioteca N. Centrale di Firenze; Dr. Giulio Carotti, Milan; Société de Borda, Dax; Royal In-

stitution, Geological Society, London; Natural History Society of Montreal; American Chemical Society, Rev. Josiah Strong, Publishers of the "Critic," New York; Rev. S. F. Hotchkin, Dr. D. G. Brinton, Messrs. John H. and Edward B. Harden, Henry Phillips, Jr., Publishers of "The American Naturalist," Philadelphia; Mr. Ira Remsen, Baltimore; Bureau of Ethnology, Department of State, Signal Office, U. S. Fish Commission, Washington; Hon. Henry R. Jackson, Atlanta, Ga.; Rev. S. D. Peet, Mendon, Ill.; Davenport Academy of Sciences; Iowa State Historical Society, Iowa City; State Historical Society of Wisconsin, Madison; Prof. Antonio Peñafiel, Mexico.

The death of Prof. Asa Gray was announced as having taken place at Cambridge, Mass., on January 30, 1888, in the 78th year of his age.

Dr. Horn exhibited seven species of *Pleocoma* from California, of which three were new, and made some remarks on Dr. Gœrstecker's criticisms on the late Dr. LeConte's views of their position. These views Dr. Horn supported and insisted that the beetle was *Laparostict Lamellicon* and not a *Pleurostict*, as asserted by Dr. Gœrstecker. Dr. Horn exhibited some dissections in confirmation of his position.

Pending nominations Nos. 1173, 1174, and 1175 were read.

Mr. Garrett, from the Committee on the Purchase of the Humboldt Portrait, reported that the sum required for its purchase, $350, had been subscribed by the members of the Society.

The President reported that he had received and paid over to the Treasurer, $132.43, the quarterly interest of the Michaux legacy due January 1, 1888.

On motion of Mr. McKean, it was resolved that prior to the next appropriation of the Michaux legacy, the subject of the proper disposition to be made of it shall be considered by the Board of Officers and Council.

And the Society was adjourned by the President.

Stated Meeting, February 17, 1888.

Present, 19 members.

President, Mr. FRALEY, in the chair.

Correspondence was submitted as follows: A letter acknowledging diploma from Dr. Edward Suess, Vienna.

Acknowledgments for Proceedings from Fondation de P. Teyler, Harlem (125); Brooklyn Entomological Society (125, 126); Philadelphia Library Co., Mr. Thomas Meehan, Philadelphia (126); Mr. John F. Carll, Pleasantville, Pa. (126); Lackawanna Institute of History and Science, Scranton (126); Kansas Historical Society, Topeka (126); Prof. Joseph LeConte Berkely, Cal. (126).

Request for exchanges from the Naturwissenschaftlicher Verein des Regierungs-Bezirks, Frankfurt a O.; which, on motion, was granted from Proceedings, No. 96.

A circular from the U. S. National Museum, Washington, relating to "rude or unfinished implements of the paleolithic type," which was referred to the Curators.

Envoys from the Mining Department, Melbourne; Naturwissenschaftlicher Verein des Regierungs-Bezirks, Frankfurt a.O.; Bureau of Ethnology, Washington.

A photograph was received for the album from Mr. Heber S. Thompson, Pottsville.

Accessions to the Library were reported from Anthropologische Gesellschaft, Wien; Verein zur Beförderung des Gartenbaues in den K. P. Staaten, K. P. Landesanstalt und Bergakademie, Berlin; Naturwissenschaftlicher Verein des Regierungs-Bezirks, Frankfurt a.O.; Verein für Erdkunde, Halle a.S.; Verein für Erdkunde, Metz; R. Società Italiana D'Igiene, Milano; R. Accademia dei Lincei, Roma; R. Academia de Ciencias Naturales y Artes, Barcelona; Mr. Horatio Hale, Clinton, Canada; Massachusetts Historical Society, Boston; Museum of Comparative Zoölogy, Harvard College Observatory, Cambridge; Astor Library, New York; American Pharmaceutical Association, College of Physicians,

Inspectors of the State Penitentiary, Mr. Henry Phillips, Jr., Philadelphia; Interstate Commerce Commission, Washington, D.C.; Cincinnati Observatory, Society of Natural History, Cincinnati; Elliott Society of Science and Art, Charleston; University of California, Berkeley; Observatorio Nacional Argentino, Buenos Ares.

The Committee appointed to examine the papers presented for the Transactions by Prof. Cope, reported progress and was continued.

The President announced the decease of Sir Henry Sumner Maine (February 3, 1888, æt. 69).

The minutes of the Board of Officers and Council were submitted.

This being the stated evening for balloting for candidates for membership, pending nominations Nos. 1173, 1174, and 1175 were read, spoken to and balloted for.

New nomination No. 1176 was read.

Prof. Cope presented, through the Secretaries, for the Proceedings two papers: 1. On the Dicotylinæ of the John Day Miocene of North America. 2. Mechanical origin of the Dentition of the Amblypoda.

The following resolution was unanimously adopted:

"*Resolved,* That the President and Treasurer be authorized to sell, not exceeding $10,000 of the Loan of the City of Philadelphia standing in the name of the Society, and the Treasurer, J. Sergeant Price, be authorized to make the necessary transfer of the same upon the books of the City."

The recommendation of Council, that the Society should procure a fire-proof for the purpose of preserving its more valuable business and literary MSS. was, on motion, referred to the Committee on Hall to consider and report thereon to the Society.

The tellers reported after a scrutiny of the ballots that the following candidates had been duly elected members of the Society:

No. 2148, Charles E. Sajous, M.D., Philadelphia.

No. 2149. Alexander Biddle, Philadelphia.

No. 2150. Edmund B. Wilson, Bryn Mawr.

And the Society was adjourned by the President.

Stated Meeting, March 2, 1888.

Present, 13 members.

President FRALEY in the Chair.

Correspondence was submitted as follows: Letters accepting membership from Mr. Alexander Biddle, Philadelphia; Prof. Edmund B. Wilson, Bryn Mawr.

A letter offering resignation from membership, from Gen. Russell Thayer, Philadelphia. On motion the resignation was accepted.

A letter from the Society of Naturalists, Kieff, Russia, requesting exchanges, which was so ordered (96–127).

The President presented a letter from the Park Engineer in reference to an annual appropriation for the *Michaux* grove, which on motion was referred to Council.

The Newberry Library of Chicago was placed on the Exchange List to receive Proceedings from No. 96.

Letters of envoy from Société Impériale Russe de Géographie, St. Petersburg; Boston Society of Natural History, Museum of Comparative Zoölogy, Cambridge, Mass.

Letters of acknowledgment from Académie R. Danoise des Sciences et des Lettres, Copenhagen (124, 125); Geological and Natural History Survey, Ottawa, Canada (126); Boston Society of Natural History (123, 124, 125, 126); Boston Public Library (125, 126); Brown University, Providence (126); Academy of Sciences, St. Louis (126).

Accessions to the Library were received from the Royal Society of New South Wales, Sydney; Geological Survey of India, Calcutta; Société Impériale Russe de Géographie, St. Petersburg; Dr. L. Samenhof, Warsaw; Académie Royale de Copenhague, Société R. des Antiquaires du Nord, Copenhague; Société R. des Sciences de Liège; Prof. Antonio Favaro, Biblioteca N. Centrale, Firenze; R. Istituto Lombardo di Scienze Lettere, Milan; École des Mines, Paris; Commissão dos Tra-

balhos Geologecos de Portugal, Lisboa; Society of Antiquaries, London; Boston Society of Natural History; Museum of Comparative Zoölogy, Harvard University, Cambridge; Providence Franklin Society; Mr. Charles J. Hoadly, Hartford; Industrial Education Association, Dr. J. S. Newberry, New York; Mercantile Library, Commissioners for the Erection of the Public Buildings, Messrs. Thomas Hockley, Henry Phillips, Jr., Philadelphia; Johns Hopkins University, Editor of the "American Journal of Philology," Baltimore; Adjutant General's Office, D. C.; Mrs. L. M. Morehead, Cincinnati; The Newberry Library, Chicago; Lick Observatory, Sacramento; California Historical Society, San Francisco.

The special committee appointed January 20th, to examine the papers of Prof. Cope, reported in favor of publishing those on the Eryops and the Puerco Fauna; on that on Lemurine Reversion it did not report favorably.

Prof. T. B. Stowell presented through the Secretaries papers on the Hypoglossal nerve, the Accessory nerve, and Glossopharyngeal nerve of the domestic cat.

Mr. Frank Jordan, Jr., presented through the Secretaries a paper on The Aboriginal Pottery of the Middle Atlantic States.

Pending nomination No. 1176 was read.

Mr. Philip C. Garrett, chairman of the committee appointed by the Society to procure for it the portrait of Baron von Humboldt, painted from life at Berlin in 1856, by Mr. J. R. Lambdin, at the request of Messrs. Henry D. Gilpin and Alexander Dallas Bache, reported that it had been purchased for $350, and on behalf of the following gentlemen who had contributed for that purpose, formally presented it to the Society: Messrs. G. W. Anderson, John R. Baker, R. Meade Bache, George H. Boker, W. G. A. Bonwill, Geo. W. Childs, E. W. Clark, J. M. Da Costa, Frederick Fraley, Philip C. Garrett, Horace Jayne, E. Otis Kendall, Wm. V. McKean, J. Sergeant Price, James W. Robins, Moncure Robinson, J. R. Shipley, Wm. P. Tatham, Frank Thomson, Richard Vaux, Joseph Wharton, Henry Winsor and Richard Wood.

Mr. Garrett in presenting the portrait made the following remarks:

"About the year 1856, while Mr. Alexander Dallas Bache was sitting to Mr. Lambdin for his portrait, the latter suggested a plan by which the Smithsonian Institution could materially aid schools in this country in procuring copies of the best foreign works of art. Having received the approval of the Board of Regents, Mr. Bache furnished Mr. Lambdin, who was about to visit Europe, with credentials from the Smithsonian to various eminent persons abroad, among others to Baron von Humboldt. It occurred to Mr. Bache *apropos* of the latter, that it would afford the artist a capital opportunity to obtain a portrait of Humboldt, which he would like to have for the American Philosophical Society, and Mr. Gilpin joining him in the purpose, they authorized Mr. Lambdin to paint a portrait of the *savant*, agreeing to see it presented to the Society upon its completion. Mr. Lambdin had an excellent opportunity with the Baron, with whom he spent the larger part of a day, on his arrival in Berlin. Humboldt was at that time the King's Chamberlain, and said that he would shortly have to go to Potsdam to attend the King, but would give Mr. Lambdin further sittings on his return to Berlin. He was then 87 years old, a little man, very much bent, extremely courteous, and was much pleased that his portrait was wanted for the American Philosophical Society, expressing gratitude to his friend Mr. *Bash* (Bache) that he had thought of it.

"The result is before the Society in an admirable and speaking likeness, and, to my mind, no more appropriate portrait adorns the walls of a Society whose scope is so philosophical and broad as that of this learned body.

"A terse and comprehensive description of the renowned philosopher is found in the following paragraph from the Edinburgh Review of 1848:

"'Science has produced no man of more rich and varied attainments, more versatile in genius, more indefatigable in application to all kinds of learning, more energetic in action, or more ardent in inquiry.'

"The same Review describes him as possessing 'a genial and kindly temperament, which excites no enmities, but, on the contrary, finds or makes friends everywhere. No man in the ranks of Science is more distinguished for this last characteristic than A. v. Humboldt. We believe that he has not an enemy.'

"It only remains for me formally to present the picture on behalf of the donors, whose names follow, and this I have great pleasure in doing. I should add that the carrying out of the original intention was prevented by the illness of Messrs. Bache and Gilpin, before the completion of the work, followed by their death."

On motion the committee was discharged and the thanks of

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the Society were voted to its chairman for his zeal and interest.

The Report of the Trustees of the Building Fund was presented.

On motion the President was requested, authorized and empowered to send with letter referred to in the Resolution of the Society of January 6, 1888, a copy of the Reports of the special committee on the value of Volapük.

On motion the Committee on Volapük was continued and requested to report from time to time on any matter kindred to the subject that may reach its knowledge.

And the Society was adjourned by the President.

Stated Meeting, March 16, 1888.

Present, 15 members.

Mr. RICHARD VAUX in the Chair.

Miss Helen C. de S. Abbott, a lately elected member, was presented to the Chair and took her seat.

Correspondence was submitted as follows:

A letter from Dr. C. E. Sajous, Philadelphia, accepting membership in the Society.

Letters of envoy from the K. Preuss. Meteorolog. Institut and K. Geolog. Landesanstalt und Bergakademie, Berlin.

Letters of acknowledgment for Proceedings, No. 125, from the Gesellschaft für Erdkunde, Deutsche Geologische Gesellschaft, Berlin; K. Sächsischer Alterthumsverein, Dresden; Oberhessiche Gesellschaft für Natur- und Heilkunde, Giessen; Naturhistorische Gesellschaft, Hanover; Dr. Otto Böhtlingk, Leipzig; Prof. Dr. Dümichen, Strasburg; H. C. de S. Abbott, Philadelphia; Dr. Jesus Sanchez, Mexico.

For Proceedings, No. 126, from the Société Géologique de France, M. Victor Duruy, Prof. Abel Hovelacque, Paris; R. Meteorological and Astronomical Societies, Board of Trade,

Geological Society, Victoria Institute, Society of Antiquaries Mr. Archibald Geikie, London; H. C. de S. Abbott, Philadelphia.

A communication from Dr. W. C. Winslow, in reference to the Egyptian Exploration Fund, was read.

Accessions to the Library were reported from Dr. Otto Donner, Helsingfors; Hungarian Academy, Buda Pesth; K. K. Zoologisch-Botanische Gesellschaft, K. K. Geologische Reichsanstalt, Wien; Naturforschende Gesellschaft, Bamberg; K. P. Geologische Landesanstalt und Bergakademie, K. P. Meteorologisches Institut, Berlin; Oberlausitzische Gesellschaft, Görlitz; Deutsche Gesellschaft für Anthropologie, etc., Baron E. de Selys Lonchamps, Liége; Société de Geographie, Paris; Instituto y Observatorio de Marina, San Fernando; Philosophical and Philological Societies, Prof. Joseph Prestwich, London; Dr. George M. Dawson, Montreal; Publishers of the "New England Magazine," Boston; American Antiquarian Society, Worcester; New York State Museum of Natural History, Albany; Publishers of "The Brooklyn Medical Journal;" Dr. Persifor Frazer, Mr. Henry Phillips, Jr., Philadelphia; Signal Office, Smithsonian Institution, Washington.

Dr. Frazer made the following oral communication:

In a recent visit to the eastern portion of Cuba under exceptionally favorable circumstances, I was enabled to obtain some interesting data on the geology of this part of the island which I believe to be new and important, and which when put into form will constitute a paper on these subjects. As my work on this paper is not complete, I do not intend to dwell upon any part of it to-night, further than to say that the area which I was enabled to examine included portions of the Sierra Mæstra range and its foot hills between Guantanamo and Santiago de Cuba; ten miles north of that city and in the neighborhood of Christo on the Enramados R. R.; and south-west of Santiago in the hills surrounding the pretty village of El Cobre. The many mines of iron, manganese and copper, and the localities where deposits of these metals were indicated, were not, however, the only interesting features to the geologist. The rocks themselves told an important tale of the age of this part of the world. Outside of an official but not exhaustive examination of this region by Señor Castro, and examinations for special purposes by Messrs. Graham, Dr. J. P. Kimball and others, no serious study of its measures has been made.

It will sufficiently indicate the importance of such a general examination when it is said that there is a strong probability of the occurrence here of a large part of the Archean rocks which lie between the Lower Laurentian and the Paleozoic, and that the metalliferous deposits which are of undoubted value take their places in a manner analogous to similar deposits in the United States and elsewhere.

It is not intended in these few hasty remarks to present any of the peculiarities of vegetation, climate and customs to the members of this Society as if these were items of news which many of them had not observed for themselves, but simply to note a few impressions which may be new to some of his hearers as they were to the speaker.

Along with the luxuriance of the vegetation, the circumstance which struck the speaker with most astonishment was the paucity of small animals and reptiles and birds in the forests. Ants and their mounds are observed everywhere, and small lizards are not uncommon, but snakes and toads and field-mice, etc., etc., were conspicuous by their absence.

During a sojourn of some weeks only one Maha, a black snake some two and a half feet in length, was seen in our journeys and camps through the forests and over the hills and mountains. The average temperature during the day, in the shade, was 81° to 86° Fah. (during the month of January), and at night this fell to 71° to 75°. There were occasional showers of rain, but as a general rule the weather was delightfully bright and calm. The temperature of a mountain stream, taken about 2000 feet above the sea at sunset, was 75° Fah.

[Numerous specimens of coral, modern shells, cocoanuts, bamboo, etc., were exhibited, as well as two drinking cups such as are fashioned by the mountaineers out of the bamboo by cutting a segment and slicing off the rim in a bevel to form a lip.]

Miss Helen C. de S. Abbott made the following remarks on the Occurrence of a Series of New Crystalline Compounds in Higher Plants:

"In many plants, especially those which belong to the natural orders, Simarubaceæ, Polemoniaceæ, Rubiaceæ, Ebenaceæ, Rhodoraceæ, and Compositæ occur, respectively, a class of compounds which present definite crystalline forms. They are extracted from the plants most readily by a light petroleum ether. Boiling absolute alcohol was used to purify these compounds from fats, wax, and coloring matter, and by fractional crystallization three distinct forms of crystals were obtained which on ultimate analyses represented compounds of different chemical constitution.

"These bodies are characterized by containing a high percentage of carbon. They are indifferent to alkalies and have high melting points. The discovery of one of these compounds in Cascara Amarga was made by me in 1884, and announced at the Buffalo meeting of the American

Association for the Advancement of Science. Since that time my investigations are continuing and, from these studies, I am able to announce, as derived from plant sources, compounds which until now have not been observed.

"Lately, from independent investigations, Prof. Henry Trimble has also discovered similar compounds in various plants. Our mutual results will form the substance of a future communication."

Mr. Henry Phillips, Jr., presented a *First Contribution* to the Folk-lore of Philadelphia and its vicinity.

Dr. Oscar Meyer presented (through the Secretaries) a paper on the Miocene Invertebrates from Virginia.

Pending nomination, No. 1176, and new nomination, No. 1177, were read.

Mr. Phillips, from the Committee on Volapük, reported on the Langue Internationale of Dr. Samenhof, of Moscow, and the Committee was continued.

And the Society was adjourned by the presiding member.

Stated Meeting, April 6, 1888.

Present, 14 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

A letter of acceptance of membership from Prof. Giuseppi Meneghini, Pisa.

Letters requesting exchanges, from the Royal Mint, Melbourne, Australia; Elisha Mitchell Scientific Society, Chapel Hill, N. C., and on motion the requests were granted.

Letters of envoy from K. Sächsische Gesellschaft der Wissenschaften, Leipzig; Gesellschaft zur Beförderung der Gesammten Naturwissenschaften in Marburg; Université Royale de Lund; Meteorological Office, Royal Statistical Society, London.

Letters of acknowledgment from Royal Society of New

South Wales, Sydney (124, 125); Prof. Peter von Tunner, Leoben, Austria; Prof. I. I. S. Steenstrup, Copenhagen; Deutsche Geologische Gesellschaft, Gesellschaft für Erdkunde, Berlin; K. Sächsische Alterthumsverein, Dresden; Oberhessische Gesellschaft für Natur- und Heilkunde, Geissen; Naturhistorische Gesellschaft, Hanover; Dr. Otto Böhtlingk, Leipzig; Prof. Dr. J. Dümichen, Strasburg; Université Royale de Lund; Dr. Jesus Sanchez, Observatorio Astrónomico Nacional, Mexico (125); K. K. Central-Anstalt für Meteorologie und Erdmagnetismus, Wien; Naturwissenschaftlicher Verein zu Bremen; Verein für Thüringische Geschichté "Isis," Dresden; Dr. G. von Rath, Bonn; Dr. Julius Platzmann, Leipzig; K. Sternwarte, München; Dr. Otto Schumann, Tübingen; Natur-Histor. Museum, Strasburg; Societé de Borda, Dax, France; Sociétés D'Anthropologie, Geologique, M. Auguste Carlier, Hon. Victor Duruy, Profs. Abel Hovelacque, Remi Siméon, Paris; Prof. Lucien Adam, Rennes, France; Philosophical Society, University Library, Rev. S. S. Lewis, Cambridge, Eng.; Royal Society, Royal Institution, Royal Astronomical, Meteorological Societies, Society of Antiquaries, Geological Society, Board of Trade, Victoria Institute, M. Archibald Geikie, Sir Richard Owen, Prof. C. Schorlemmer, Manchester; Natural History Society, New Castle-on-Tyne; Dr. Henry W. Acland, Oxford; Dr. James Geikie, Edinburgh; Prof. C. H. Hitchcock, Hanover, N. H. (126); Physiologische Gesellschaft, Berlin (96–126, etc.).

Accessions to the Library from the Linnean Society of New South Wales, Sydney; Geological Survey of India, Calcutta; Royal Asiatic Society, North China Branch, Shanghai; K. Akademie der Wissenschaften, St. Petersburg; Societé Impériale des Naturalistes de Moscow; K. K. Geographische Gesellschaft in Wien; Naturwissenschaftliche Gesellschaft "Isis," Dresden; K. Sächsische Gesellschaft, Leipzig; Gesellschaft zur Beförderung der Gesammten Naturwissenschaften, Marburg; K. Statistische Landes-Anstalt, Stuttgart; University of Lund, Sweden; Academie Royale de Belgique, Bruxelles; Société Americaine de France, "Cosmos," Paris; Prof.

Joseph Prestwich, Shoreham, Eng.; Bath and West of England Agricultural Society, Bath; Royal Statistical Society, Meteorological Council, "Nature," London; Prof. Eben Norton Horsford, New York; Mr. W. J. Potts, Camden; Academy of Natural Sciences, Historical Society of Pennsylvania, Messrs. Henry Phillips, Jr., Richard Wood, Philadelphia; Elisha Mitchell Scientific Society, Raleigh, N. C.

A photograph for the album was received from Dr. Julius Platzmann, Leipzig.

The following deaths of members were reported:

F. Bowyer Miller, Melbourne, September 17, 1887.

James Curtis Booth, Philadelphia, March 21, 1888, æt. 78.

Joseph Zentmayer, Philadelphia, March 28, 1888, æt. 62.

On motion, the President was authorized to appoint suitable persons to prepare the usual obituary notices for Messrs. Booth and Zentmayer.

Mr. Law presented, for the Proceedings, a paper on "Gildas and Early English History."

Mr. DuBois, from the Committee on Revised Spelling, appointed January 6, 1888, reported progress, and the committee was continued until it should be ready to make a final report.

Prof. Edwin J. Houston made the following oral communications:

On Death by the Electric Current.

Several cases of death have resulted from incautious or accidental touching or handling of the wires employed in carrying the currents used in electric lighting. It becomes, therefore, a matter of great importance to inquire into some of the peculiarities of such accidents.

There are, as is well known, two distinct characters of current employed for the purpose of electric illumination; viz., the direct current and the alternating current. The direct current, as employed in electric lighting, is fairly steady and uniform. Its electro-motive force, as a rule, is not subject to marked changes in value, and the direction of its flow is always the same. The alternating current, on the contrary, changes both the value of its electro-motive force and its direction, taking its name from the fact that it flows alternately in opposite directions. The changes in the electro-motive force are considerable in amount; they are not, however, as is very generally believed, necessarily sudden, since in most cases the

electro-motive force changes gradually from a maximum to a minimum in both directions.

Death has resulted from the incautious handling or accidental contact both with the direct and with the alternating current.

In the case of the direct current, death results sometimes from shock, but generally, it would appear, from an electrolytic effect on the blood or other tissues of the body. The gaseous products arising from the decomposition possibly may, in some cases, be carried by the blood to the heart and thus stop its action, or, as probably occurs in most cases, death may result from electrolytic changes produced in the blood itself, or in other tissues.

Death by the alternating current probably results from shock only. Resuscitation in cases of apparent death are more frequent with the alternating current than with the direct, most probably from the absence of actual electrolytic decomposition of the tissues.

Considerable surprise has often been manifested because certain currents, that, in some instances, have been handled with impunity, in other cases have caused death. A current of a certain number of ampères, and of a certain difference of potential between the points touched, caused death in one case, while in another case with the same current strength in the line, two or three times the difference of potential between the points touched, was received with impunity.

Making due allowance for differences in vitality, or in the condition of the heart-power of the subject, I think the following explanation will throw light on many of these cases. I offer it, however, mainly, though not entirely, from a theoretical standpoint.

The explanation would appear to be found in the portions of the body at which the current enters and passes out, which would of course necessarily be influenced by the position of the person receiving the discharge. Nearly all fatal or severe shocks occur from the lines being accidentally grounded at some point. The person then either deliberately touches, or is accidentally brought into contact with the line at some other point. Under these conditions, the electricity either passes into or out of the body at the feet. The greater or less probability of serious results will depend on the parts of the body through which the current passes. When any part of the body is placed in the path of an electric discharge, more of the discharge will pass through the better conductors, which perhaps will, generally, be the great nerve trunks and the muscles. Reference must, therefore, be had to the position of such nerve centres, as well as to the heart, the lungs and the viscera and other vital organs. The following contacts are among the commonest.

(1) At the head. This contact is apt to be among the most dangerous, as the discharge in all probability takes place through some of the vital organs, such as the brain, the upper part of the spinal cord, or through some of the organs in the abdominal cavity, or their principal nerves.

(2) At the shoulders. This is probably somewhat less dangerous than

the preceding, as the brain is not in the path of the direct discharge. The vicinity of the upper part of the spinal cord is, however, very dangerous.

(3) At one of the hands. If the person is standing on both feet, this may be fatal, since the organs of the abdominal cavity and its nerve centres are in the path of the discharge. If the person is standing on one foot, then if this foot be on the same side of the body as the hand that is touched, the discharge will probably not be fatal, since the discharge does not necessarily pass through the organs of the abdominal cavity. If, however, the foot on which the person is standing be on the other side of the body from the hand that touches the wire, that is if the person be standing on the right foot and touches the wire with his left hand, the discharge, if powerful, is apt to be fatal, since the organs of the abdominal cavity and its nerves are necessarily in the path of the discharge.

(4) On the back, especially in the upper portion. This is apt to be fatal, since the spinal cord is dangerously near the path of the discharge. The muscles of the back are also very large and would thus determine the passage of much of the current in this direction.

(5) Discharges ensuing on touching the wires with each hand are apt to be fatal, since the heart lies in the path of the current.

Those exposed to electric discharges would be protected from the effects of accidental grounding of the conductors, by wearing plates or discs of any high insulating material on the soles of the shoes, or inside the same.

Death by lightning probably results from the effects of shock, combined with those of electrolysis. In discharges of such enormous difference of potential as exist in lightning, disruptive effects may also be produced.

The almost instantaneous and consequently painless nature of death by the electric shock has, as is well known, led to the suggestion that it be employed in public executions in place of hanging or decapitation. Should such suggestion be adopted, the character of the apparatus employed should be such as to cause death by shock, followed, to avoid the possibility of resuscitation, in case of apparent death, by the passage of an electrolyzing current.

On the Paillard Palladium Alloys in Watches.

I have concluded my experiments on the Paillard watches. The following results were reached; viz.,

I am satisfied that a watch whose balance-wheel, hair spring, and escapement are made of the Paillard palladium alloys can not have its rate sensibly affected by the influence of any magnetic field into which it is possible to bring it while on the person of its wearer.

In order to test this, such watches were carried into exceedingly powerful magnetic fields, and although carefully rated, both before and after exposure, no sensible change in their rate could be detected.

Experiments showed that the palladium alloys are entirely destitute of any paramagnetic properties. As far as the amount of the alloys at my

disposal permitted, experiments failed to show that they possessed any diamagnetic properties.

A number of these alloys are made by Mr. Paillard. The composition of four described by him in his U. S. patents, and numbered for convenience Nos. 1, 2, 3, 4, is as follows, viz:

Palladium Alloy No. 1.

Palladium	60 to 75 parts.
Copper	15 to 25 "
Iron	1 to 5 "

Palladium Alloy No. 2.

Palladium	50 to 75 parts.
Copper	20 to 30 "
Iron	5 to 20 "

Palladium Alloy No. 3.

Palladium	65 to 75 parts.
Copper	15 to 25 "
Nickel	1 to 5 "
Gold	1 to $2\frac{1}{2}$ "
Platinum	$\frac{1}{2}$ to 2 "
Silver	3 to 10 "
Steel	1 to 5 "

Palladium Alloy No. 4.

Palladium	45 to 50 parts.
Silver	20 to 25 "
Copper	15 to 25 "
Gold	2 to 5 "
Platinum	2 to 5 "
Nickel	2 to 5 "
Steel	2 to 5 "

The complete masking of the paramagnetic properties of some of the ingredients of these alloys is of considerable interest, and would seem to indicate a true chemical union of their constituents. The most interesting results of my experiments, however, were those in which it was established that no matter of what materials the balance wheel or hair spring may be made, provided they are conductors of electricity, their movements through a magnetic field, when the moving masses properly cut the lines of force, must result in a change in their rate of movement, and consequently in a change in the rate of the watch; or, briefly, it was established that *a watch placed in a magnetic field acts like a dynamo-electric machine.*

The amount of this action is exceedingly small. In order to detect it, a very powerful magnetic field must be employed, and the watch subjected to its influence for an hour or more.

In order to obtain this field, and to properly concentrate it on the rim of the balance wheel (thus placing said rim in a position analogous to the copper disc in the well-known experiment between the poles of an electro-magnet), I mounted massive conical pole pieces, of soft iron, inside the pole pieces of the armature field of an Excelsior arc-light machine, whose armature had been removed. The space left between the opposing ends of these pole pieces was just sufficient to permit the introduction of the watch.

The watch was then securely fixed in place, with its face upwards, so that the lines of magnetic force, concentrated on that part of the edge of the balance wheel nearest the edge of the watch, passed through it at right angles to the plane of its movements. After an exposure of one hour to the influence of this extraordinary field, *the watch was found to have gained fifteen seconds.*

I believe that the cause of the gain is to be ascribed to a decrease in the arc of oscillation of the balance wheel, which would thus result in an increase in the rapidity of its movements.

The fact that the watch, after its removal from this powerful field, did not manifest any sensible change in its rate, shows the extent of the protection the palladium alloys give it against the effects of external magnetism.

The Committee on Volapük reported that it had considered the communications from Prof. P. Steiner, of Darmstadt, in reference to the claims of *Pasilengua* for adoption as a universal language, and those of Prof. G. Bauer, of Agram, in reference to his improved Volapük, entitled *Speling*, and offered the following resolution for the consideration of the Society.

The Society having considered the communications from Dr. Steiner in reference to *Pasilengua,* and Dr. Bauer in reference to *Speling,* in view of its resolution of January 6, 1888, proposing a Congress to consider the project of an International Scientific Language, while recognizing the full value of Dr. Steiner's labors and the changes made by Dr. Bauer, must decline to commit itself in advance of any action by such Congress to any individual scheme, however meritorious.

The resolution was, on motion of Mr. Vaux, unanimously adopted.

Pending nominations Nos. 1176 and 1177 and new nomination No. 1178 were read.

And the Society was adjourned by the President.

Observations on Gildas and the Uncertainties of Early English History.

By Philip H. Law.

(*Read before the American Philosophical Society, April 6, 1888.*)

Historians and antiquarians have been inclined to base their statements too much on guesses. Pyramids of very doubtful conjecture have been erected on a foundation of a very few facts : and those facts very uncertain. The pregnant aphorism of Dr. Johnson that history written from facts not recorded at or near the time of their happening is a mere work of the imagination, should be constantly present to their minds. But, alas, it is generally ignored, for if it were applied it would reduce the vast volumes of archæological learning to a very small compass.

Any one reading the early history of England in the popular historians and of its conquest by the so-called Anglo-Saxons, but who called themselves the Æglisk, would believe that our knowledge of the events of its conquest were certain ; at least, as certain as the events of the reign of Edward I.

But if we examine the sources of information we will find them to be profoundly unreliable. That a conquest did occur, a severe and drastic one, cannot be doubted or denied. The great change of language establishes this ; absolutely proving the obliteration or enslavement of the native population. The latter was, according to the probabilities, the case.

The captive of a rude and warlike people is too useful to be slain except in the heat of battle. The barbarian hates persistent work ; his labor is war ; his enjoyments are the chase and the wassail bowl ; and land, without slaves to work it, is for him but of little use.

The historians of the Anglo-Saxon Conquest draw their facts from the monk Gildas. And to these the writers of the picturesque school, such as the late Mr. Green, add facts drawn from their imagination ; for example, Mr. Green in his special history of the period describes, as if he was an eye-witness what is a matter of pure conjecture, giving a most vivid account of the sack of Anderida, the line of march taken by the different Saxon bands, how they fought, and what they did.

But as to these we have but one authority who has even pretensions to be a contemporary—Gildas, the British monk. A few casual but not connected remarks occur in Continental writers. Britain in the days of the Roman Empire was a very obscure and very unimportant dependency. It was not more important to the Roman Empire then than New Zealand is now to the present English Empire. Naturally, therefore, very little importance was attached to what happened there ; indeed, the whole Latin literature of the time, except in theology, is scanty. The Anglo-Saxons were completely barbarous and without letters. No record was kept by them of their conquest. Gildas, therefore, is our only authority, and if his authenticity is disproved, complete darkness will cover the subject of

the Anglo-Saxon Conquest, except such inductions as we may form from change of language.

I will, therefore, examine the claims of Gildas. He is reputed to have been a Welsh monk who wrote about 520 A.D.; and his youth would have been nearly contemporaneous with the Saxon invasions. The book is in Latin and bears the title of "De Excidio Britanniæ;" and covers about fifty or sixty pages of a small duodecimo volume. It is composed of two parts, distinct in their nature; the first containing the history of the invasions; the second, a long, rambling account of remarkable events which occur in the Biblical narrative. The style is most singular. It is not a mere dry narrative of events like most of the so-called Chronicles, interspersed with naive and quaint remarks; but it has a distinct lyrical tone and manner, with a kind of rhythmical flow of the sentences; indeed, it reads like a prose chant. It commences with a description of the wickedness of the Britons, ascribing to them all manner of sins. After the departure of the Roman armies they fall into divisions and civil wars. The Picts attack them, and upon their doleful complaints to the Romans, the Romans return, drive out after many battles the Picts, and to secure them from further attacks, build the great wall. Upon their departure the Picts recommence their attacks. The Britons send again for the Romans, who, after conquering the Picts, build another and larger wall from sea to sea, protected by large castles erected upon it. But this does not prevent the Picts from entering and commencing fresh attacks, harrying and destroying the whole country. The Romans returning to their frantic appeals a deaf answer, Vortigern, one of their kings, calls in the Saxons, and here occurs the well-known tale of Vortigern and Rowena. The Saxons, from being merely auxiliaries, quickly take advantage of the weakness of their allies and proceed to subjugate them; and, being joined by numbers of their kinsfolk from across the sea, gradually conquer the whole of Britain.

This is the account found in almost all the English histories as the reliable account of the Saxon Conquest. Historians desirous of forming a connected account, naturally do not like to acknowledge ignorance of the most important event and revolution in the annals of the country; no less than a complete change in its language and probably a partial change in the blood of the people, certainly of that of the ruling class.

But to archæologists who require proof, Gildas has always appeared a most unhistorical writer and of no authenticity. Several facts which lie patent in his book have always struck them as entirely inconsistent with a contemporary author such as he claims to be; and first, his peculiar style, which is utterly unlike what a contemporary historian would use. It appears much more like a poem turned into prose than a dry narrative of facts. And second, from his notorious errors in history, in which he narrates as contemporaneous, events which had occurred long before; for instance, his describing the civil wars of Maxentius and Constantine as occurring about that time when they occurred nearly a cen-

tury before. And, above all, from his describing as then being built, the two great northern walls of defense, while we know that one of them had been built by Hadrian nearly three hundred years, and that the other, the wall of Severus, nearly two hundred years. These facts, in my opinion, are crucial tests. It is possible, perhaps, for a contemporary to be mistaken as to the civil wars, but how could it be possible to make such a mistake about a fact which was so patent as the building of those great walls?

As well could a person who pretended to live in A. D. 1888 in Philadelphia, assert that the great city hall was erected by William Penn.

Such a statement would stamp at once its author, whatever his pretensions might be, as not a contemporary.

Besides this many of the facts which we know from the Roman records and from the remains of the burials and other records, are inconsistent with the common story of the Saxon Conquest.

From the Notitia Imperii, which was a survey of the Roman Empire taken in the end of the fourth century, we learn that the whole of the east coast was already called the Litus Saxonicum, the Saxon Shore ; and was governed by a special Count, thus probably indicating that a large population of that race was already there settled.

From the remains disinterred from the tombs it appears that the Saxons and Britons were frequently buried side by side, each corpse in the respective national manner.

Another remarkable fact also appears from the inspection of these tombs, that scarcely any appearance of Christian burial has been found. From this it would seem that most of the British population still remained Pagan ; a fact which will perhaps explain why the Saxons did not, like the Franks, the Goths, the Allemanni, adopt Christianity.

The information furnished by the Welsh chroniclers seems always to have been particularly unreliable. They are full of inventions which are plainly the work of their own fancies. In Nennius, who is a Welsh writer on the history of Britain, and who cannot be later than the commencement of the tenth century at the farthest, the legend of King Brute and his Trojans already begins. This was finally developed in Geoffrey of Monmouth, a Welsh Bishop about 1150 A. D., who starting from King Brute develops a long line of Kings until the time of Julius Cæsar. He gives their names, the incidents of their reigns, their personal peculiarities and their speeches, with a detail and a certainty almost amazing. Frequently these contradict the well-known facts related in the Roman historians. The Roman history, though well known at the time from the manuals like Orosius and others which were extensively copied and read in the middle ages, does not seem to inspire him with any doubt. It has always struck me as a most singular historical problem why such fables and inventions could have been so readily accepted. They were given place in almost all the histories of England which were written until the time of the Renaissance, and were apparently accepted as completely credible, and indeed almost to the commencement of the seventeenth century.

Also they scarcely seem to have been the result of conscious invention. Geoffrey of Monmouth was apparently a man of good character and a Bishop of the church. His position, therefore, seems to render it improbable that he committed a complete literary forgery like that of George Psalmanazzar; and if he did not, what was the origin of these tales?

I conjecture, although I have very little proof to offer, that it may have originated something in this way. The Welsh chieftains were all fond of poetry, and kept in their service bards to sing their praises and that of their ancestors. Long genealogies were spun out connecting them with the great of the olden time. The license of song and verse would naturally increase the facility of invention.

This poetry would gradually in an uncritical age become considered veritable history, and finally, clipped of its ornaments, be turned into sober prose, and make its appearance as authentic history. An enormous mass of Welsh poetry is, I believe, in existence, mostly unprinted, and it would be very interesting and instructive if some scholar learned in Welsh, and with access to the manuscripts, would examine if the legendary history of Britain did not originate in this manner.

The same causes would explain the legendary history of Scotland, the darkness of which is incomparably greater than that of England. Indeed, it seems to me that with the exceptions of the glimpses afforded by the occasional notices of English chroniclers, nothing definite is known until about the time of Edward I of England.

A long series of kings is given with the events of their reigns, yet no explanation is given of the change from a Celtic-speaking people to an English-speaking people, apparently about the year 1000 A. D. The lowlands of Scotland were a people who used Gaelic and were governed by kings with characteristic Celtic names of Macbeth, MacDuff, Duncan, Malcolm, and with institutions of the regular clan or tribal nature. But when the light of history becomes bright and clear, they speak a dialect of English, their institutions are of the feudal rather than the clan type—their kings and nobles have names either Teutonic or Norman in the etymology; and yet of this great revolution there is not a word in history.

On Miocene Invertebrates from Virginia (With Plate).

By Otto Meyer, Ph.D.

(*Read before the American Philosophical Society, March 16, 1888.*)

Prof. J. J. Stevenson, of the University of New York, has collected a quantity of Miocene material near Yorktown, Va. In his collection there are quite a number of specimens of large species in fine preservation, like Mercenaria tridacnoides Lam. sp., Panopea reflexa Say, Ecphora

quadricostata Say sp., and others. He transmitted to me recently for examination some little shells and some sand adhering to some of these large shells, in which material the species enumerated below were found. Partly they are already known to occur in Yorktown, for their greater number, however, they are described from other localities of the Atlantic Miocene. A few forms are new or new to the American Tertiary.

Some of the determinations were made from the published descriptions and figures, but in many cases these are insufficient for a determination, especially as far as the smaller species are concerned. Therefore, frequently the type-specimens in the collection of the Academy of Natural Sciences were compared and especially the forms described by H. C. Lea, from Petersburg, Va.,* had to be studied. My thanks are due to the Curator in charge of the Academy, Prof. A. Heilprin, who enabled me to study a great number of fossil types. Besides, I am obliged to the Curator of Molluscs of the Academy, Mr. Geo. W. Tryon, Jr., who gave me the opportunity to compare recent material. †

It is here not attempted to give the ultimate names of all the enumerated species, for this would presuppose a nearly complete working up of the Atlantic Miocene palæontology, including a comparison with recent, Eocene and European forms. But the opportunity is used at least in some cases to unite species, which, in my opinion, are synonyms. The following list of smaller species from Yorktown, Va., will probably be increased considerably in future, as the quantity of examined sand was only a small one.

I. Species known from the Atlantic Miocene.

Lamellibranchiata.

Ostrea sp. (juv.)
Anomia Ruffini Conr.
Plicatula marginata Say.
Lima papyria Conr.
Pecten eboreus Conr.
Arca centenaria Say.
Arca carolinensis Conr.
Pectunculus lentiformis Conr.
Pectunculus subovatus Say.
Nucula diaphana H. C. Lea.
Leda acuta Conr.
(= Leda carinata H. C. Lea.)
Yoldia lævis Say sp.
Carditamera arata Conr.

* Transact. Amer. Philos. Soc., Vol. ix, pp. 229–274.

† Since the above was written, Science has lost a valuable worker in Mr. G. W. Tryon, Jr., whose death occurred on Feb. 5, 1838.

Venericardia granulata Say.
Venericardia tridentata Conr.
Astarte vicina Say.
Astarte undulata Say.
Crassatella undulata Say.
Gouldia lunulata Conr.
Chama congregata Conr.
Kellia lævis H. C. Lea sp.
Erycinella ovalis Conr.
Lepton mactroides Conr.
Diplodonta acclinis Conr.
Lucina crenulata Conr.
(= Lucina Leana d'Orb.)
(= Lucina lens H. C. Lea.)
Venus cortinaria Rogers.
Circe metastria Conr.
Tellina lusoria Say.
Tellina producta Conr.
Semele subovata Say sp.
Saxicava arctica Linné, var. bicristata Conr.*
Mactra modicella Conr.
Corbula cuneata Say.
(= Corbula inæqualis Say.)

Glossophora.

Dentalium attenuatum Say.
Cadulus thallus Conr. sp.
Chiton transenna H. C. Lea.
Fissurella catilliformis Rogers.
Adeorbis concava H. C. Lea sp.
(= Delphinula lipara H. C. Lea.)
Teinostoma subconica H. C. Lea sp.
Delphinula costulata H. C. Lea.
Trochus torquatus H. C. Lea.
(= Trochus Ruffini H. C. Lea.)
Trochus lens H. C. Lea.
(= Delphinula trochiformis H. C. Lea.)
Natica sphærulus H. C. Lea var.
Crucibulum grande Say.
(= Infundibulum concentricum H. C. Lea.)
Crepidula fornicata Lam.†

* See Proc. Acad. Nat. Sci. Phila., 1884, p. 108.

† Most of the species of Crepidula, described from the Atlantic Miocene, if not all of them, are apparently synonyms of this form. It is very variable and specimens of different age, shape and ornamentation have received specific names.

PROC. AMER. PHILOS. SOC. XXV. 127. R. PRINTED MAY 10, 1888.

Turritella terstriata Rogers.
Turritella quadristriata Rogers.
Turbonilla exarata H. C. Lea sp.
Turbonilla daedalea H. C. Lea sp.
Turbonilla eburnea H. C. Lea sp.
Turbonilla subula H. C. Lea sp.
Odostomia granulata H. C. Lea sp.
Eulima eborea Conr.
(= Pasithea lævigata H. C. Lea.)
Cerithiopsis clavulus H. C. Lea sp.*
(= Cerithium annulatum Emmons.)
Oliva ancillariæformis H. C. Lea.
Tornatina Wetherilli J. Lea sp.
(= Tornatina cylindrica Emmons.)
Bulla subspissa Conr.

Balanus concavus Bronn.

A tergum of a Lepadide, apparently of Scalpellum magnum Wood, Darwin, unfortunately was lost, together with a very minute specimen of an Ostracod, Cythere sp. No species of an Ostracod has been found heretofore in the Atlantic Miocene. Scalpellum magnum,† however, has been found at Petersburg, Va., but misinterpreted. The carina has been described by H. C. Lea as Patella acinaces,‡ and the scutum as Avicula multangula,§ and these species appear in the Miocene lists of Conrad‖ and Meek.¶ Prof. A. Heilprin, in his list of Tertiary fossils from Virginia, also enumerates Patella acinaces,** while Avicula multangula is put among those species of H. C. Lea which are "based upon young shells, or upon such as barely admit of characterization. ††

As my opinion about these fossils differs so essentially from that of a number of authors, I consider it necessary to give the figures of the type-specimens in the collection of the Academy of Natural Sciences in Philadelphia (Fig. 11, 11*a*, 12, 12*a*), so that others may be able to form their own judgment. The original figures of H. C. Lea are not sufficient for this purpose.

* One of my specimens has three embryonic whorls preserved. They are smooth and this apparently shows that the species is not identical with the Eocene Cerithiopsis constricta H. C. Lea sp., although adult specimens without nucleus look alike. See Berichte d. Senckenberg. Naturf. Gesellsch., Frankfurt a. M., 1887, p. 8, Pl. 2, fig. 23; and see Proc. Acad. Nat. Sci. Phila., 1884, p. 105.

† Darwin, fossil Lepadidæ, p. 18, Pl. 1, fig. 1.

‡ Trans. Amer. Philos. Soc., Vol. ix, p. 247, Pl. 35, fig. 36.

§ *Ibid.*, p. 245, Pl. 35, fig. 31.

‖ Proc. Acad. Nat. Sci., 1862, p. 570, p. 579.

¶ Smithson. Miscell. Collect., 183, Nov. 1864, p. 14; p. 6.

** Contrib. to the Tertiary Geol. and Palæont. of the U. S., p. 57.

†† *Ibid.*, p. 48.

II. Species New to the American Tertiary.

Cæcum stevensoni n. sp. Figure 4.

Relatively large; regularly and well curved. Shell thick. Surface closely covered by strong longitudinal costæ, which are usually alternating. Septum mucronate.

If the shell is kept horizontal, its convexity towards the observer, the mucronation of the septum appears on the left side. Its size and position is variable, sometimes it is nearly marginal, sometimes subcentral. The costæ are usually broader than the interstices between them and alternating, but in some specimens they are nearly equal. The younger part of two specimens shows indications of rings, producing a very slight cancellation. There is a contraction at the aperture, but it is confined to the margin of the aperture and nearly imperceptible. Besides the regular form there occur smaller specimens of equal ornamentation, but different shape. They have a less cylindrical tube, the increase in width towards the aperture being much larger. The same small and tapering form occurs with the following species. Wood observed the same form occurring with the Crag species of Cæcum. He considered them at first as distinct species, and then described them as varieties (see Crag Mollusca, Vol. i, p. 116, Pl. 20, fig. 4*b*). I think they are the adolescent state of the species.

I have not become aware of a form of the European Tertiary, with which to compare C. stevensoni, and no costated Cæcum is known from the American Tertiary. Specimens of the recent Cæcum cooperi Smith were compared and proved to be somewhat similar, but specifically different. They have fewer and thinner ribs, are distinctly cancellate and have a different shape. C. stevensoni is quite common in Yorktown.

Cæcum virginianum n. sp. Fig. 3.

Relatively large; regularly but slightly curved. Shell thick. Septum prominent, angular. Surface smooth, with concentric striæ of growth.

The mucronation of the septum is situated and is variable, like in the preceding species. Specimens of the adolescent state have a more tapering form, as in the preceding species.

A similar European fossil is apparently Cæcum mammillatum Wood,* from the Crag; which, however, is more curved and has a less angular and more mammillated septum. About the differences with other smooth species of the American Tertiary see below. Similar recent species are apparently Cæcum chinense de Folin † and Cæcum læve Adams.‡ I have not been able to compare specimens of these two species. C. chinense, according to De Folin's figure, seems to be more slender and more tapering and the septum seems to be different. C. læve is described as shining and is apparently a shorter species.

* Wood, Crag Mollusca, Vol. i, p. 116, Pl. 20, fig. 4.

† De Folin, Fonds de la mer, Vol. i, p. 80, Pl. 9, fig 3-4.

‡ See Tryon's Manual of Conchology, Vol. viii, p. 215, Pl. 66, fig. 52.

Cæcum glabrum Montague var. Fig. 5.

Dentalium glabrum Mont., Testacea Britannica, p. 497.

Small ; regularly curved ; cylindrical surface smooth, shining. Septum not prominent, convex, very slightly mucronate.

Those specimens of the recent C. glabrum which I was able to compare had a septum as regularly curved as a watch glass and without any mucronation. The septum of the Yorktown specimens, however, though at first sight also regularly convex, shows at a closer examination in nearly all cases a slight mucronation, and for this reason I consider it necessary to call the Yorktown specimens a variety. The Crag species which Wood described as C. glabrum* resembles perhaps more to this Miocene form than to the recent one. C. glabrum is not rare in Yorktown.

The following is a brief review of the species of Cæcum known as yet from the American Tertiary :

Eocene.—1. Cæcum solitarium Mr.,† Vicksburg, Miss., of middle size, regular curvation, smooth surface and contracted at the aperture. 2. Cæcum alterum Mr.,‡ Jackson, Miss., similar to the preceding, but slightly annulated.

Miocene.—3. Cæcum annulatum Emmons,§ North Carolina. A specimen is in the collection of the Academy. It is very strongly annulated. 4. Cæcum stevensoni Mr., Yorktown, Va., coarsely costated. 5. Cæcum virginianum Mr., Yorktown, Va., smooth, large, thick, rather straight, septum prominent and angular. 6. Cæcum glabrum Mont. var., Yorktown, Va., smooth, small, thin, curved with flattened septum.

Pyramis promilium n. sp. Fig. 1.

Small, subulate. The dextral nucleus is followed by five adult whorls. They are somewhat convex, ornamented by revolving punctuate striæ, about four on each whorl. Base rounded, covered by similar striæ. Mouth oval. Inner lip with a small receding fold. Outer lip thin.

The figured specimen is not entirely adult and though not specifically different differs somewhat from the rest. It is less slender and the only one in which the punctuate nature of the revolving striæ can be distinctly recognized. The fold on the columella is hardly perceptible when the mouth is perfect, as in the type-specimen, but is more conspicuous in broken specimens.

While in the Yorktown material most of the small species described by H. C. Lea from Petersburg, Va., were found, Actæon milium H. C. Lea was not detected. But, as it were in place of it, above similar species occurs. At first sight Actæon milium seems to be very different, because it has a stout form and a stronger fold. The amount of slenderness, how-

* Crag Moll., Vol. i, p. 117, Pl. 20, fig. 6.
† Bull. i, Geol. Survey Ala., p. 68, Pl. 3, fig. 9.
‡ Ber. d. Senckenberg. Naturf. Gesellsch., 1887, p. 6, Pl. 1, fig. 8.
§ Emmons, Geology of North Carolina, p. 274, fig. 190.

ever, seems to be not quite constant, and the species are apparently allied. The only similar recent shell seems to be Pyramis striatula Couthouy* (= ? Menestho albula Fabr.), which form, however, is much larger and without visible fold, apart of other differences.

Turbonilla paucistriata ? Jeffreys. Fig. 2.

? Odostomia paucistriata Jeffreys ; Proc. Zoöl. Soc., London, 1884, p. 361; Pl. 27, fig. 6.†

The sinistral nucleus, which is twisted outwards, is followed by five adult whorls. They are flattened and covered by broad, flat, straight ribs, about fifteen on the last whorl. Suture impressed. Base rounded, smooth. Mouth pear-shaped. Outer lip thin.

The interstices between the ribs are mere furrows. On the younger whorls these furrows are not equal and not regularly arranged. Only two specimens were found, and they are, probably, not quite adult. The figured one has a volution less than the other, but a perfect mouth.

Turbonilla exarata H. C. Lea sp., of the same locality, is less slender, its whorls are more convex and the ribs are strong and obliquely set. Turbonilla subula H. C. Lea sp., of the same locality, is considerably stouter, has convex whorls and strong ribs. Turbonilla eburnea H. C. Lea sp., of the same locality, has sharply cut revolving striæ between the ribs. The form agrees with the description and figure of T. paucistriata Jeff., but I have not been able to compare specimens of this recent species and therefore am not entirely certain about this determination.

Astarte orbicularior n. sp. Fig. 6.

Shell, thick, flat. Suborbicular, umboneal margins more or less straightened, ventral margin rounded. Beak very small, medial. Lunule flat, lanceolate. Hinge broad, cardinal teeth strong. Muscular impressions suboval, about equal, anterior one with separate auxiliar. Margin entire. Surface smooth or with a few concentric undulations.

The species is flatter and more orbicular, than any one that has been described from the Atlantic Miocene. It is variable in form and young specimens are more convex, more trigonal, and the beak is turned more

* Boston Journ. Nat. Hist., ii, p. 101, Pl. 1, fig. 6, and Gould, Invert. Mass., p. 269, fig. 174.

† J. G. Jeffreys, On the Mullusca procured during the Lightning and Porcupine Expedition. On page 364 the genus Mathilda is placed in the Pyramidellidæ. I considered this position of Mathilda probable in the Berichte d. Senckenberg. Naturforsch. Gesellsch., 1887, p. 6, without having been aware, at that time, that Jeffreys pronounced the same idea in 1884.

On page 365, Pl. 27, fig. 10, Jeffrey's describes the new genus Gegania. I am not aware of any generic difference of this genus and Tuba J. Lea, and the recent Gegania pinguis Jeffreys, and the Eocene Tuba striata J. Lea (Contrib. to Geology, p. 128, Pl. 4, fig. 117) seem to be rather allied species.

distinctly anteriorly. They approach in their form Astarte coheni Conr.* and Astarte symmetrica Conr.† and indicate that the species has been derived from the usual trigonal form of Astarte. A similar recent shell, judging from the figure, seemed to be Astarte quadrans Gould,‡ but a comparison of specimens proved that there is no resemblance.

Leda pygmæa ? Muenster. Fig. 7, 7*a*.

?Nucula pygmæa Muenster, Goldfuss, Petref. German. Vol. ii, p. 157, Pl. 125, fig. 17.

Small ; triangularly ovate ; subequilateral. Without distinct lunule or corselet. Shell rather thick. Hinge broad, with about fourteen teeth altogether. Pallial sinus small. Surface smooth.

Only the figured specimen was found and no opportunity has yet been found to compare it with the German typical specimens. What Wood describes as Leda pygmæa Muenst. from the Crag§ has been separated by Weinkauff‖ from the German species and identified with the recent Leda tenuis Philippi.¶ It seems to have a thinner shell and more teeth than the German Oligocene form. The Yorktown specimen has a solid shell and relatively few teeth.

Modiolaria petagnæ Scacchi. Fig. 8.

Modiola Petagnæ Scacchi, Philippi, Enum. moll. Sic. Vol. ii, p. 51 ; Vol. i, Pl. 5, fig. 11.

Oblong ; ventricose ; angular posteriorly. Anterior side contracted, extending beyond the umbo. Anterior and posterior surface radiately ribbed, the ribs decreasing in size towards the middle and not existing on the middle. Whole surface moreover irregularly concentrically striated. The radiating ribs crenulate the inner margin. Inside somewhat nacreous.

Both the concentric and radiating ribs are not regularly arranged, taking their origin by bifurcation of other ribs. By the crossing of the ribs the anterior and especially the posterior surface appear cancellate.

The shell agrees with the Crag form, which Wood described as Modiola costulata Risso,** comparing it with the figure of Philippi in the Enumeratio molluscorum Siciliæ, Vol. i, p. 70, Pl. 5, fig. 11, referred by Philippi himself in Vol. ii, p. 51, to M. petagnæ Sc. But Wood considered M.

* Conrad, Mioc. Fossils, p. 43, Pl. 21, fig. 5.

† *Ibid.*, p. 44, Pl. 21, fig. 7. I have seen specimens labeled with Conrad's handwriting "Astarte coheni," but with entire margin, while he describes this species with crenulated margin, like A. symmetrica. Altogether I am not aware of any specific difference between the two forms, even if the margins should differ.

‡ Gould, Invert. Mass., p. 81, fig. 48.

§ Crag Moll., Vol. ii, p. 95, Pl. 10, fig. 11.

‖ Weinkauff, Conchilien d. Mittelmeeres, Vol. i, p. 211.

¶ Phil., Enum. Moll. Sic., Vol. i, p. 65, Pl. 5, fig. 9.

** Crag. Moll., p. 60, Pl. 8, fig. 6.

costulata and M. Petagnæ only as varieties of the same species. A comparison of specimens of the two recent forms, however, convinces me, that they are different, and this is apparently the general opinion. The Yorktown form agrees specifically with specimens of M. Petagnæ from Greece, and agrees in every detail with specimens of M. Petagnæ from the Canary islands. The recent M. lateralis Say, though generally stouter, is similar and perhaps might be united with M. Petagnæ.

Modiola phaseolina Philippi. Fig. 9.

Philippi, Enumer. mollusc. Sic., Vol. ii, p. 51, Pl. 15, fig. 14.

Nacreous. Oblong-ovate. Ventral margin straight or subsinuated, dorsal margin subangulated. The small cardinal area is finely striated and the interior part of the dorsal margin is minutely crenulated within. Surface with striæ of growth.

Modiola ducatelli Conr.* from the Atlantic Miocene is a large, elongated and flattened species of apparently very different form. The type and only specimen has only the outside exposed so that interior characters cannot be determined. More similar seems to be Modiola inflata Tuomey & Holmes.† But this species is founded on a single and incomplete impression and I am unable to determine its specific characters. The Yorktown specimens agree with Philippi's description and figure of M. phaseolina from the Crag‡ and with recent specimens from the coast of England.

Semele ? virginiana n. sp. Fig. 10, 10*a*.

Only the figured right valve of this form has been found. As the shell is solid, the adductors are well marked and the pallial line very strongly impressed, I think the specimen is adult, or at least adult enough to show its generic and specific characters. Its main peculiarity is the position of the cardinal teeth, which are not below the beak. Altogether I do not think that the shell can be properly placed into the genus Semele or any other existing genus, but it may be named this way until more material is found. It may be described in the following way.

Minute; compressed; not gaping. Subcuneiform, posterior side short, beak being rather terminal. Anterior margin regularly rounded, posterior margin truncate. Anterior muscular impression orbicular, sinuated anteriorly; posterior muscular impression elongated, sinuated posteriorly. Pallial sinus deep. Below the small beak there is a subquadrangular cartilage pit, anterior to which there is vertical and rather strong cardinal tooth. A second cardinal tooth adjoins it, which is obsolete, oblique and formed by a slight increase of the continuation of the anterior lateral tooth. Lateral teeth strong; the anterior one is long, the posterior one of

* Conrad, Mioc. Foss., p. 53, Pl. 28, fig. 2.
† Pliocene Foss. South Carolina, p. 33, Pl. 14, fig. 3.
‡ Crag Moll., p. 59, Pl. 8, fig. 4.

about half its length. Surface regularly, closely and strongly concentrically ribbed, the ribs disappearing near the umbo. Lunule small; indistinct.

Miliolina seminulum Linné sp.

One specimen has been found only and has been determined as above by Mr. A. Woodward, in New York. Though no foraminifera is mentioned in Meek's Miocene Check List (Smithsonian Miscellaneous Collections, 1864), J. Lea has described a species from the Miocene of Maryland as Miliola marylandica,* and it is very probable that this name is a synonym of above.

EXPLANATION OF PLATE.

Fig. 1. Pyramis promilium n. sp. ..... Yorktown, Va.
" 2. Turbonilla paucistriata ? Jeffreys..... " "
" 3. Cæcum virginianum n. sp..... " "
" 4. Cæcum stevensoni n. sp..... " "
" 5. Cæcum glabrum Montague var..... " "
" 6. Astarte orbicularior n. sp..... " "
" 7, 7a. Leda pygmæa ? Muenster..... " "
" 8. Modiolaria petagnæ Scacchi..... " "
" 9. Modiola phaseolina Philippi. ..... " "
" 10, 10a. Semele ? virginiana n. sp..... " "
" 11, 11a. Carina of Scalpellum magnum..Petersburg, Va.
(type of Patella acinaces H. C. Lea.)
" 12, 12a. Scutum of Scalpellum magnum.. " "
(type of Avicula multangula H. C. Lea.)

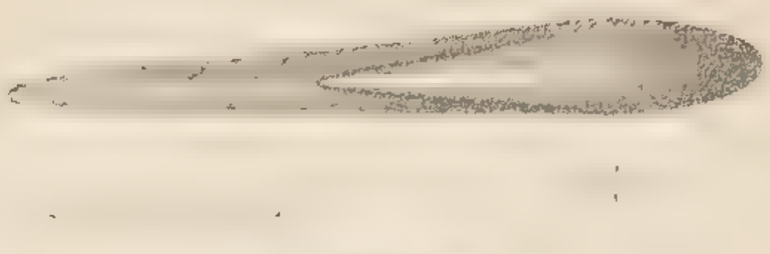
On some Possible Methods for the Preparation of Gramophone and Telephone Records. By *Prof. Edwin J. Houston.*

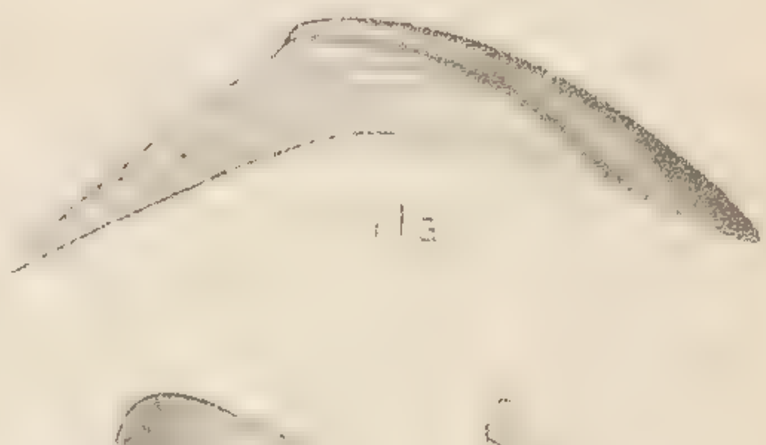
(*Read before the American Philosophical Society, April 20, 1888.*)

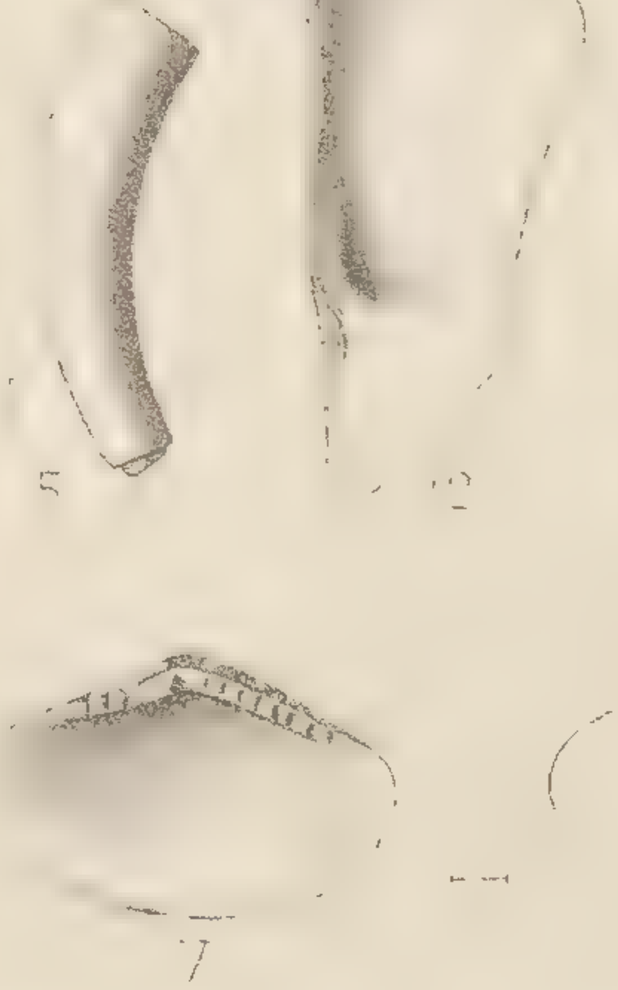
Phonograph records, of the type employed by Mr. Berliner in his gramophone, *i. e.*, those obtained by causing the point or stylus attached to the vibrating diaphragm to move parallel to the recording-surface instead of perpendicular thereto, can be prepared more readily, and by a greater variety of methods, than is possible with record-surfaces of the old forms.

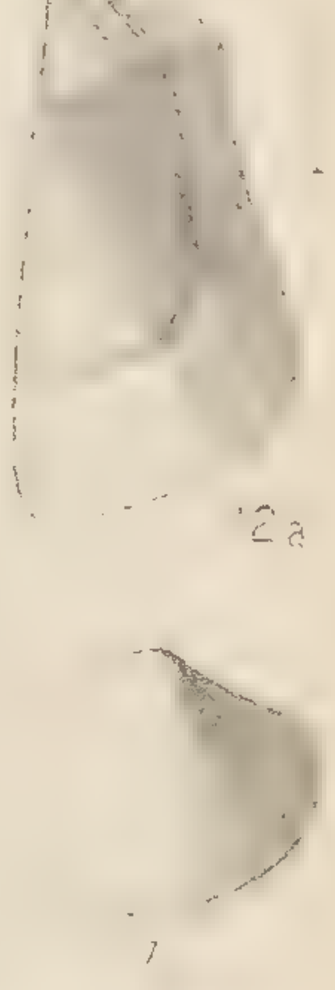
In a study of the later forms of phonographic apparatus, several methods of preparing gramophone plates have suggested themselves to the author, which he hopes soon to be able to put to the test of actual trial. These methods, though particularly applicable to records horizontally traced,

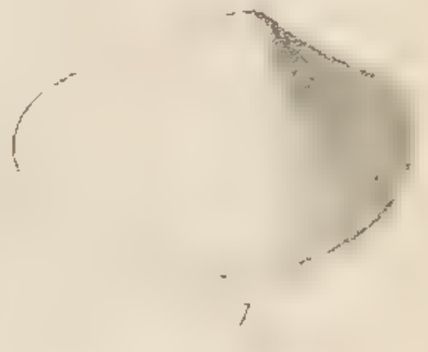
* Contrib. to Geology, p. 215, Pl. 6, fig. 227.

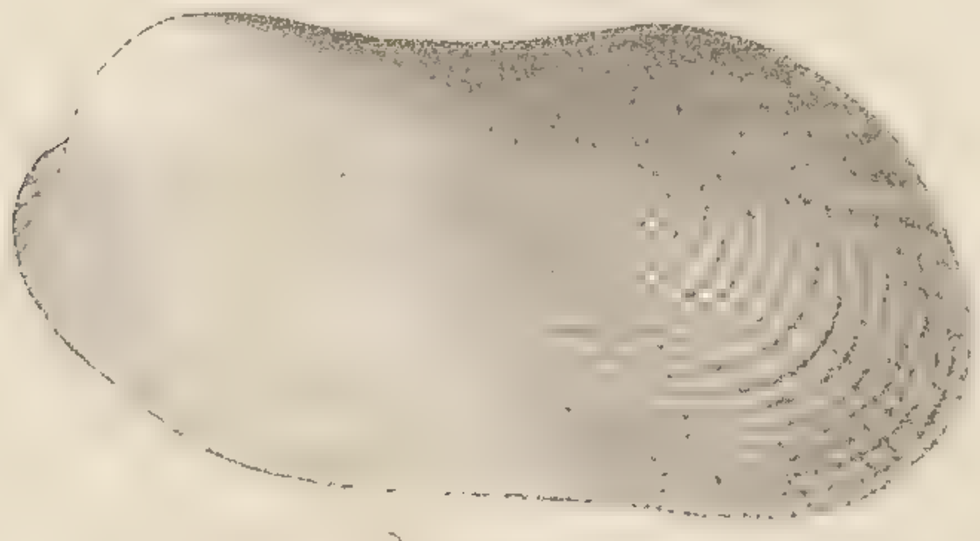


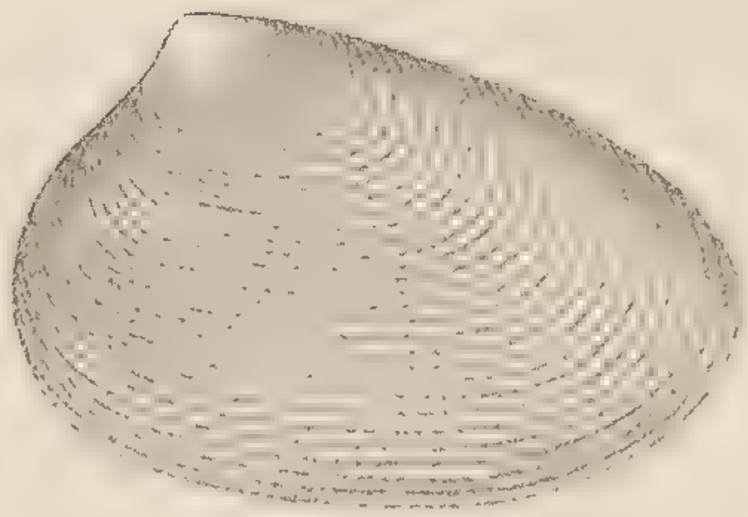












may, in certain cases, by slight modifications, be applied also to those vertically traced.

In order to place some of these methods on record, a brief description will be given of a few of the most promising. At the same time, the author admits that serious difficulties may lie in the way of practically carrying out some of the methods proposed.

Mr. Berliner, as is well known, prepares his record-surfaces by moving the tracing point over the surface of a plate of inked glass or metal, covered with a uniform deposit of lamp-black. The record thus obtained is either mechanically copied on a metal surface, or is reproduced thereon by the process of photo-engraving, or etching. I would suggest the following methods, viz.:

(1.) After the record on smoked glass is obtained in the usual manner, expose the plate to the action of a regulated sand-blast so as to obtain cuttings or groovings on the surface of the plate, suitable for the movements of the reproducing diaphragm. Roughness in the edges of the lines so obtained would probably cause screaming sounds in the words reproduced, which might be removed by a few applications of an emery-covered tracing point.

Should the action of the sand-blast remove the coating of lamp-black and ink on the covered portions of the plate, these portions might be rendered more adherent by the freer use of a more viscous ink, and the deposition of finer spiculæ of carbon.

(2.) The phonogram record-surface is composed of a smooth surface of hardened wax, on a composition of wax and resin which is *locally heated* so as to *slightly soften the surface* directly under the tracing point or stylus.

In order to ensure the rapid cooling and hardening of the surface, immediately after the impression has been impressed thereon, the heating must be local and not general. To more thoroughly ensure local cooling, a light blast of cool air might be directed on the surface almost immediately after the tracing has been made. To prevent the air so applied from cooling the surface that is being warmed in order to receive the record, a suitably arranged diaphragm may separate adjacent cooled and heated portions.

(3.) Instead of heating the record-surface itself, a local source of heat may be used to heat the tracing point or stylus. This heat may be either ordinary heat, or that of electrical origin. When the stylus, instead of the record-surface, is heated, the latter may be made of much harder material.

Any tendency of the record-surface to run and thus mar the correctness of the recorded sounds, may be checked by the use of a properly directed blast of cold air as already suggested under (2).

It is evident that the use of cold air, or its equivalent, is much more suitable in this case than where the record-surface itself is heated.

Any tendency of the surface or tracing-point to clog may be remedied by suitably shaping the cutting-surface of the point, or the composition of

the record-surface, or the degree of temperature employed for the softening.

(4.) The record-surface consists of a glass plate covered with a thin layer of wax. Either the record-surface itself, or the marking stylus, is locally heated as before, only the layer of wax is so thin as to leave the glass exposed after the passage of the tracing-point. The cooling blast of air, and the separating diaphragm described in (3) are applicable to this process.

A permanent record is then etched in the surface of the plate so prepared either by the sand-blast process, or, preferably, by the action of hydro-fluoric acid.

Before the application of either the sand-blast or the acid, care should be taken to see that the lines traced are free from wax.

(5.) Instead of employing the records on the lamp-blackened glass surface as a photographic negative for the purpose of reproducing them by photo-engraving or etching, they may be used for transferring the record to a glass surface covered with a film of sensitized gelatine. The portions of the glass that are left uncovered after the plate is fixed are then deeply cut or etched by treatment with either gaseous or diluted liquid hydro-fluoric acid.

I have treated a gelatine-covered glass plate printed from a photograph by means of this process, and find that it produces a very fair and permanent picture on the glass.

It is evident that this process will leave the design either in relief or intaglio according as a photographic negative or positive is used.

(6.) The recording diaphragm, in its movements to and fro, is caused to deposit, on the surface of the record-plate, a uniformly thick line or layer of some rapidly hardening substance. This substance is contained in a vessel provided with a pointed outlet tube, and attached to the diaphragm. The material either runs out by its weight and is deposited on the record-surface, or is forced out by the movements of the diaphragm itself.

The substance may be rendered fluid while in the containing vessel by the action of heat, hardening on cooling, which latter may be hastened by a suitably directed blast of cooled air.

A record, thus prepared, would consist of a uniformly thick, sinuous ridge of the hardened material. The reproducing stylus, or that giving motion to the diaphragm that reproduces the speech, could, it is evident, be operated either from the upper or the lower surfaces of the sinuous ridge independently, or from both simultaneously.

(7.) If the movements of the receiving diaphragm of a telephone be sufficiently amplified or intensified to permit it to trace or cut a sinuous record on a suitably prepared record-surface by any of the methods proposed in this article, or by any other method, then there would be produced a simple, yet effective method for obtaining not only a permanent record of a telephonic dispatch, but as well a means of reproducing it as often as might be desired.

Success could hardly be looked for by means of any device that left the record on the record-surface by movements at right angles thereto; for, since the movements of the telephone diaphragm are exceedingly minute, and the amount of energy represented thereby exceedingly small, it is hardly to be expected that a record of any value could be so produced. But with a record recorded by movements parallel to the surface, and received on a surface whose resistance to motion is small, the difficulties would not appear to be insurmountable.

It should be carefully borne in mind that a telephone record may be made of very small dimensions. Indeed, in the case of any phonographic apparatus, where it is not intended that the record should reproduce the sounds by direct mechanical movements of the diaphragm, large records are not always necessary nor are they even desirable; for, such reproduction may be effected electrically.

Where the telephone record-surface has been prepared, no effort should be made to cause it to reproduce the telephonic despatch mechanically. *An electrical method of reproduction is far the preferable one.*

(8.) The following method would appear to promise excellent results. Employ the telephone-record to act mechanically on a lever or other device, but instead of attempting to cause the movements of such a lever to impart audible, articulate motion to a receiving diaphragm, cause them to act directly on a variable resistance in the circuit of which is included a voltaic battery and a receiving telephone. Since, for such an operation, very slight movements of the variable resistance contacts are required, it is by no means improbable that some of the methods proposed, or, obvious modifications thereof, will, in practice, be found applicable for the production of a permanent telephone record.

The advantages of a telephonic record thus obtained arise not only from its permanency, but also from the possibility of preparing a phonographic record of the voice or message, and sending the same for telephonic transmission over a line to a distant point.

(9.) Before concluding this brief sketch, it might be well to suggest the following plan, which would appear to be particularly suitable for obtaining a telephone record: Mount a concave mirror at the centre of the diaphragm of the receiving telephone; or, better yet, from the entire diaphragm of a concave mirror, shaping the magnet pole of the telephone to conform to the approximated surface thereof. When the telephone is receiving transmitted speech, allow the light reflected from the diaphragm-mirror, and suitably concentrated by a lens, to fall on a sensitized photographic plate placed in a plane at right angles to the plane of the diaphragm, so as to receive the spot of light parallel to its surface. The photographic plate must, of course, be moved mechanically at right angles to the direction of movement of the spot of light. The plate thus acted on is then developed, fixed, and used to reproduce the record by any of the well-known methods of photo-engraving, etching, etc. The record thus obtained may be used either mechanically to reproduce the trans-

mitted speech in an ordinary phonographic apparatus, or, preferably in connection with a variable resistance contact, electrically in a receiving telephone.

There can be no doubt, whatever, that this method will be found operative in practice, since the engraving stylus, a pencil of light, is destitute of weight, and therefore offers no resistance to the free movements of the telephone diaphragm.

(10.) Instead of causing the voice, as in the ordinary form of phonographic or gramophonic apparatus, to act mechanically on the record-surface, cause it to move a suitably focussed pencil of light over the surface of a photographic plate. A very complete record could thus be obtained, in which it would be possible to impress on the plate all the minute peculiarities of the overtones, on which the quality of the voice depends. In this manner there could be obtained and preserved records of the voice of distinguished individuals.

The photographic method just described would possess, among others, the following advantages, viz.:

1st. The ease with which it could accurately reproduce in all their minutiæ the tones involved in the production of articulate speech.

2d. The readiness with which such a record could be magnified to any desired extent, thus rendering possible an increase in the amplitude of the reproduced vibration.

3d. The aid such magnified, accurate sound-records would afford in the study of the same with a view, not only of ascertaining their peculiarities, but even with a view of being able to read articulate speech directly from the diaphragm record.

CENTRAL HIGH SCHOOL,
PHILADELPHIA, *April 6, 1888.*

Stated Meeting, April 20, 1888.

Present, 14 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

A letter from Washburn College, Topeka, Kansas, requesting exchanges; on motion, ordered to receive Proceedings from No. 96.

A letter from Prof. Joseph Prestwich, with change of address (Shoreham, Sevenoaks, Kent).

A letter of envoy from the Meteorological Office, London.

Letters acknowledging receipt of Proceedings, No. 126, from Sir William Thompson, South Kensington Museum (London) and M. Claudio Jannet, Paris.

The President reported that he had received letters in response to the circular in reference to a Congress to consider the question of an International Language, from James M. Taylor, President of Vassar College, Poughkeepsie, N. Y.; D. C. Gilman, President of Johns Hopkins University, Baltimore, Md.; Prof. W. LeConte Stevens, Brooklyn, N. Y.; Prof. B. L. Gildersleeve, Baltimore, Md.; President of the University of South Carolina; Director of the U. S. Nautical Almanac.

Accessions to the Library were received from Prof. George Bauer, Agram, Austria; Prof. P. Steiner, Darmstadt; Naturwissenschaft Verein, Frankfurt, a. O.; Geographische Gesellschaft, Hanover; Prof. Giuseppi Sergi, Rome; R. Academia di Ciencias, Madrid; Rousdon Observatory, Devon; Meteorological Council, British Association, Dr. B. W. Richardson, "The Earth," London; Historical and Scientific Society of Manitoba, Board of Trade, Winnipeg; Archæological Institute of America, Boston; Museum of Comparative Zoölogy, Cambridge; R. I. Historical Society, Providence; New York State Museum of Natural History, Albany; Buffalo Historical Society; Academy of Sciences, Prof. J. S. Newberry, New York; Mr. W. J. Potts, Camden; Geological Survey of New Jersey, Trenton; University of Pennsylvania, Mercantile Library, Profs. Lewis M. Haupt, Edwin J. Houston, Messrs. Henry Phillips, Jr., Richard Vaux, Com. E. Y. McCauley, Philadelphia; Departments of Justice, State and the Interior, Captain John G. Bourke, Washington, D. C.; University of Virginia; Prof. N. H. Winchell, St. Paul; California Academy of Sciences, San Francisco; Prof. Mariano Bárcena, Mexico.

The President stated that pursuant to the resolution of the Society, he had appointed P. DuBois, Esq., to prepare the obituary notice of Prof. James Curtis Booth, and Dr. John A. Ryder that of Joseph Zentmayer, and that they had accepted the appointments by letter.

Prof. Houston presented a communication on Some Possible

Methods for the Preparation of Gramophone and Telephone Records.

Mr. Phillips exhibited some specimens of *Physa heterostropha* found in water from the pipes of the drinking supply furnished by the Schuylkill river this and last Spring.

Prof. Houston and Dr. Morris spoke in relation to the impurity and insufficiency of the water supply of the city.

The President referred to the volume and condition of the water passing over the Fairmount dam, stating that the area of the pool has diminished but very little in later years, and that in his opinion the drinking water of the city was as pure as that supplied to New York and better than that to Boston. The President stated that he possessed a manuscript essay by Henry Campbell, C. E., of this city, containing a project for supplying City of New York with water by putting a very high dam some distance above the city, so as to prevent the salt water running up, and thus utilizing all the fresh water supplied by the Hudson river.

For Philadelphia, he proposed to collect the rain water in tanks and distribute it as needed.

Dr. J. Cheston Morris said that perhaps the supply water-pipe referred to by Mr. Phillips contained some bend in which the ova lodged and were hatched from time to time—the ova subjected to heat in the hot water-pipe being killed. Observation of our ordinary Schuylkill supply would soon satisfy one of the frequent existence in it of many forms of animal life. We greatly need in this city sufficient reservoirs for subsidence; our supply would then be comparatively good, and free from much of the present cause of complaint. The scouring of the pools and basins of the dams of the Schuylkill, which occurs during the freshets, would then remove much noxious material.

Prof. Houston having suggested the great lakes as probably a good future source of supply for our Eastern cities, Dr. Morris said, the results of their employment at Chicago were not such as to encourage us. And New York would hardly like to take the Erie canal as its source.

A serious question is that of change occurring in waters long impounded in reservoirs; but he believes, with Mr. E. F. Smith, that the waters of such reservoirs drawn from a distance of at least six or eight feet below the surface and as much above the bottom, so as to avoid the confervoid and bacterial growths near the surface, and the organic remains of previous life which settle to the bottom, would give the best results attainable. It has been shown also, by experience, that water contaminated with organic matter has a tendency to purify itself, in rapidly flowing streams interrupted by cascades or riffles, by the growth of animals and plants of the lower orders. While speaking on the subject, he would allude to the excellent character of the water supply from the Schuylkill as to its solid ingredients. Water may be too pure, *i. e.*, deficient in those salts and earthy matters which tend to maintain tissue-metamorphosis and growth; lime salts in moderate quantity are beneficial, while magnesian are irritant, purgative and unsatisfying to the thirst—as are the waters of the Paris basin—while excess of lime salts, as in the Mississippi Valley, gives rise to calculous concretions. Many diseases can thus be traced to defective water supply.

The greater amount of organic matter in the water of the upper Delaware is the result of its drainage from the swamps and vegetable decaying matters on the mountains above the Water Gap. Much of the impurity of the Schuylkill is gotten rid of in the precipitation which occurs in its course from the traversing by its waters, acidulated from the mines, of the limestone bed of rocks above Reading.

Mr. McKean was of the opinion that the assumption, because there is some albuminoid matter in the water we get from our hydrants, it is therefore unwholesome, was unfounded. He was doubtful if it had been made clear that the *albuminoids* and other matters presumably unwholesome, found in the supply of drinking water as furnished to us, are really unwholesome unless accompanied by antecedent extraneous fever germs. He adverted to the low death-rate of London and Philadelphia as militating against the theory of the great unwholesomeness of their drinking water.

In reply to a question by Mr. McKean, as to the proof of disease resulting from waters containing ammonia, Dr. Morris said we should carefully distinguish between albuminoids, and albuminoid ammonia and free ammonia. No one would doubt the unhealthiness of water contaminated with decaying or putrescent albuminous matters. The amount, however, of albuminoid and free ammonia—with the chlorides and nitrites—enables us to trace the previous life history of the water. As to such a supply being injurious to health, the record of the U. S. Army during operations along the Chickahominy, and the experiences of Dr. Livingstone and Stanley in Africa, afforded the illustrations required.

Dr. Kœnig was of the opinion that the Schuylkill water was very much abused and was better than it looked. Its looks could be easily remedied by filtering. The substances in solution in Summer and Winter only differed by a *few milligrams to the litre*. The purifying action of the forebay was very great; that there was no appreciable difference in free ammonia above and below the dam.

Dr. Kœnig believed that the danger of infection from disease germs from fecal matter in running water was very much overrated.

Dr. Horn and Mr. Burke also spoke on the subject.

The *Ives' Stratigraphic Geological Map* was exhibited and explained to the Society.

Pending nominations Nos. 1176, 1177, and 1178, and new nominations Nos. 1179 and 1180 were read.

The Committee on the Library reported having held a full meeting and having agreed on the purchase of a number of Encyclopedias, Dictionaries, etc., and works of reference, as ordered by the Society.

On motion, the Society authorized the construction of book-cases to contain these works of reference, at a cost not to exceed $50.

The Publication Committee reported having authorized the publication of Prof. Cope's papers on the *Eryops* and on the *Puerco Fauna*, and that the same would finish the second part

of the XVIth Volume of the Transactions, which would then be issued.

The President reported that he had received and paid over to the Treasurer $132.76, the quarterly interest due April 1, 1888, on the Michaux Legacy.

And the Society was adjourned by the President.

Stated Meeting, May 4, 1888.

Present, 29 members.

President, Mr. FRALEY, in the Chair.

Prof. W. P. Wilson, a lately elected member, was presented to the Chair, and took his seat.

Correspondence was submitted as follows, viz.: Program of the Annual Poetic Contest for the Prizes awarded by the Academia Regia Nederlandica.

Letters of envoy from Société de Litterature Finnoise, Helsingfors; K. Sächsische Gesellschaft der Wissenschaften, Leipzig.

Letters of acknowledgment from Société Royale des Sciences de Liège; Prof. G. Sergi, Rome; Radcliffe Observatory, Oxford, England; Buffalo Library (126); Newberry Library, Chicago; Elisha Mitchell Scientific Society, Chapel Hill, N. C. (96–126); Prof. C. V. Riley, Washington, D. C. (119).

The President reported that he had received, in answer to the proposed invitation for a congress to consider the project of an international scientific language, letters from Institute of Technology, Boston, Mass.; W. E. A. Axon, Manchester, England; Dr. L. Samenhoff, Warsaw, Russia; Yorkshire Geological and Polytechnic Society; Dr. F. S. Krauss, Vienna, Austria.

PROC. AMER. PHILOS. SOC. XXV. 127. T. PRINTED MAY 15, 1888.

Accessions to the Library from Prof. G. vom Rath, Bonn; K. Nordiske Oldskrift-Selskab, Copenhagen; "Flora Batava," Leiden; Nederlandsche Bontanische Vereeniging, Nijmeguen; R. Academia de Ciencias, Madrid; R. Meteorological, R. Astronomical Societies, London; Canadian Institute, Mr. James T. V. Ives, Toronto; Society of Civil Engineers, Boston; Providence Public Library; American Oriental Society, New Haven; Buffalo Library; New York Meteorological Observatory; Messrs. William Harden, B. S. Lyman, Henry Phillips, Jr., Philadelphia; Light House Board of the United States, Washington, D. C.; Prof. John C. Branner, Little Rock, Ark.; University of Michigan, Ann Arbor; Iowa State Historical Society, Iowa City; University of California, Berkeley; Direccion General de Estadistica, Guatemala, S. A.

The Committee appointed December 16, 1887, to prepare the Magellanic Medal, reported that the same was now ready and delivered it to the President, who gave it to Prof. L. M. Haupt with the following address:

"Prof. Haupt, it is a great gratification to me, both personally and officially, to present to you the Magellanic Premium, which has been awarded by the American Philosophical Society for your essay on 'The Physical Phenomena of Harbor Entrances, their Causes and Remedies.' This essay treats of matters of great national importance, and your discussion of them will greatly tend to the improvement of the methods now in use for effecting the permanent removal of the obstacles in our harbors and rivers, which are so dangerous to navigation and are so full of risk to the lands and buildings along their shore-lines. A glance at the map of the United States will show the great number of our navigable rivers and the vast extent of coast-lines, and their valuable and important harbor entrances. And it is therefore important that the money appropriated for their improvement and enlargement shall be wisely and scientifically expended. I think your suggestions will be found very valuable in securing stability to all artificial structures that may be erected in our great waters for their protection and convenient use, and you are therefore entitled to be honored as a public benefactor. The Magellanic Premium was established in the year 1786, and the records of the Society show that only six awards of the medal and one honorary pecuniary premium have been made within the century. Yours is therefore the seventh premium. It is thus shown that the terms under which the premium can be claimed are difficult to be

met, but you have filled them, and I sincerely and cordially congratulate you on your success."

Prof. Haupt made the following reply:

"Mr. President and fellow-members of the American Philosophical Society:—Accepting this estimable token of approval, which this distinguished Society has conferred upon the results of my investigations, it gives me great pleasure to express to you my grateful obligations for this unusual mark of approbation.

"The conditions accompanying applications for the Magellanic Premium being such as to eliminate entirely all personal elements, I felt that the opportunity of obtaining a critical and impartial investigation of my researches was thus admirably presented, and that no more competent body, organized for scientific research, could be found to pass judgment upon a matter which I deemed of great importance to the commercial, scientific and engineering development of our country.

"I was pleased, therefore, to embrace this opportunity of presenting the paper on 'The Physical Phenomena of Harbor Entrances' to the American Philosophical Society for consideration and action. Whatever value the paper may have, and the weight and influence it may exert in the future, in modifying the plans for meeting the difficult requirements of maritime works, are chiefly due to the careful and deliberate consideration which your Society and committees have given to the subject; and, deeply as I feel the honor, as well as the responsibility, which this approval of my labors places upon me, I earnestly hope you will permit me to state that, whatever may be my share of the merit conferred, it is but the reflection of that emanating from yourselves as members of this learned Society.

"To me your endorsement is at this time particularly encouraging, for already I find myself in the position of the pioneer who breaks loose from the well-trodden highways and seeks to discover a new path through the trackless waste. His task is full of responsibility, and he needs to keep well in view his landmarks; sometimes ahead, at others behind him. So I find myself looking back for my bearings whilst I am pressing forward toward the goal, which is the introduction of these plans at some suitable port of entry along our coast.

"The difficulties which I expected to find, and do find, in this effort are those resulting from conservatism and inertia of the Government machinery; but they are inherent to all development and furnish additional evidence of the soundness of the conclusions you have already reached. It is, therefore, with peculiar satisfaction that I look upon this medal, the seal of your approbation, not as upon an *ignis fatuus*, to lure me on to destruction, but as a talisman to encourage me in pursuing the way I have taken as one leading to a laudable end.

"The discussions, which opposition must provoke, should result in elucidating more clearly the principles embodied in these physical studies and in removing them more and more from the domain of theory and planting them upon the firmer foundations of fact.

"By this means they will be brought to the knowledge of the unprofessional reader and receive the support of those most directly interested in their application.

"I have observed that in dealing with physical questions, involving only inert matter, the problems are comparatively simple, whilst those of a social character which enter the domain of mind become exceedingly complex, yet these two classes appear to be almost inseparably related. In developing an engineering project, the first stage is that of mental conception and evolution; the second, that of education and propagation; and the third, that of execution or construction. It is in the second stage where the greatest difficulties are encountered, for it is always a difficult task to undertake to modify prevailing impressions. The contest is an unequal one, but when the changes proposed are based upon and allied to Truth they must ultimately prevail. Otherwise, they must as certainly fail, and this is therefore the crucial stage.

"A distinguished philosopher says: 'The best way to come to Truth is to examine things as really they are, and not to conclude they are as we fancy of ourselves, or have been taught by others to imagine.'

"If we could but lay aside previous impressions and prejudices it would be an easy matter to apply this advice to see things 'as really they are,' but, unfortunately, judgment is too often blinded by habit or education. This prevalent propensity of accepting statements without investigation, or of reaching conclusions from superficial observations, has led mankind into many errors which can only be removed by searching and impersonal discussions. Such discussions, therefore, should be welcomed as tending to the perfection of knowledge and the revelation of Truth.

"The studies which I have submitted to you have been my recreation and delight, and in pursuing them I have realized the truth and beauty contained in these lines from 'Thalaba :'

"'Learn thou, O young man,
God hath appointed wisdom the reward of study!
'Tis a well of living waters,
Whose inexhaustible bounties all might drink,
But few dig deep enough.'

"The treasures of wisdom are only to be unearthed by digging deeply, and I believe it accords with the experience of every investigator, that the deeper he delves the more treasure he discovers. Especially is this true when applied to investigations relative to the laws of the physical world, and, as each increment of knowledge is added to that already gleaned, the mind of the devout student becomes more and more fully impressed with the sense of his own impotence and of the infinite majesty and wis-

dom of Him who, from the beginning, conceived, created and continually maintains the universe; to whom belongs all the glory, praise and honor of our feeble efforts forever.

"This idea of our dependence upon the Supreme Being your committee have very happily embodied in the motto which they have placed upon the medal: '*Non mutare Dei leges, sed in hominum usum adhibere.*'" *

On motion, the Society recommended that Prof. Haupt accede to the request of Messrs. Bailey, Banks & Biddle for a temporary loan of this medal, it being, according to their statement, the finest they have ever made.

The following communications were made for the Proceedings of the Society:

By Dr. T. Sterry Hunt, "On the Classification and Nomenclature of the Metalline Minerals."

By Dr. E. D. Cope, "On the Ear Bones of the Permian Batrachia."

Dr. Alfred Dugés (Mexico) presented through the Secretaries a paper on "Deux Especes Nouvelles des Ophidiens de Mexique."

* NOTE.—The Medal is of gold, oval in form, two and a quarter inches long by one and seven-eighths wide. The inscription (in alto-relievo) on the obverse is:

THE
PREMIUM
OF
JOHN HYACINTH
DE MAGELLAN,
OF LONDON.

Around the margin and separated from the panel by a heavy laurel wreath, is the motto prepared for the committee, which reads "*Non Dei leges mutare, sed in hominum usum adhibere.*"

On the reverse,

AWARDED
BY THE
AMERICAN
PHILOSOPHICAL
SOCIETY
TO
LEWIS M. HAUPT,
for his discovery in
Physical Hydrography
and for his invention of
a System of Harbor
Improvement.

Around the margin:

Philadelphia, Pennsylvaniensis,
December, MDCCCLXXXVII.

Prof. C. V. Riley referred to a possible error of transcription in the volume of Early Proceedings (No. 119) on pages 14, 15, as to the word *Hessian fly*.

On motion, the Committee on Hall was requested to consider the desirability of speedily procuring the fire-proof safe ordered by the Society on February 17, 1888.

The Society, on motion, approved the bill of Bailey, Banks & Biddle for $170, for the dies and metal of the Magellanic medal, and ordered that the same be paid.

Pending nominations Nos. 1176–1180 were read.

And the Society was adjourned by the President.

PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY,

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

VOL. XXV. JULY TO DECEMBER, 1888. No. 123.

First Contribution to the Folk lore of Philadelphia and its Vicinity.

By Henry Phillips, Jr.

(*Read before the American Philosophical Society, March 16, 1888.*)

The present paper contains only such popular superstitions as have come under my notice. To make the subject cover a larger ground, say the State of Pennsylvania, or the United States, would be to open the door to a liability to error; and more good can be done by efforts of individual observers, each taking his own surrounding district, than by grasping after too great a number of items of folk-lore, perhaps too readily accepted as universal, while really only local. To the local searcher, therefore, must the bulk of such work be confided, knowing that from the mass of entirely reliable individual collections, the general principles that underlie them all will be ultimately evolved from correct data. All of these are at least a half century old, unless where otherwise stated.

BIRTH, DEATH AND MARRIAGE.

1.— Who changes her name and not the letter,
Marries for worse and not for better.

2.—Rice is thrown over a bride so that some of it falls in her bosom (a custom that has originated in the past twenty years).

3.—An old shoe is thrown after a departing couple after marriage.

4.—When one shivers some one is walking over their grave.

5.— The child that's born on Sabbath day
Is blithe and bonny, good and gay.
Monday's child is fair of face,
Tuesday's child is full of grace,
Wednesday's child is born for woe,
Thursday's child has far to go,
Friday's child is for loving and giving,
Saturday's child has to work for a living.

6.—Marriages have the following results, according to the day on which celebrated :

Monday for health, Tuesday for wealth,
Wednesday the best day of all,
Thursday for losses, Friday for crosses,
Saturday no day at all.

Variant. Monday for wealth ;
Tuesday for health ;
Wednesday the best day of all ;
Thursday for crosses ;
Friday for losses ;
Saturday no luck at all.

7.—It is unlucky to marry in May.

8.—A bride must wear

Something old and something new,
Something borrowed, and something blue.

The borrowed is apt to be a handkerchief ; the blue, garters.

9.—A child must first be taken up stairs before it is taken down ; otherwise it will never rise in life.

10.—Women lose a tooth at every confinement.

11.—A piece of wedding-cake if placed under one's pillow will bring a dream of one's future spouse.

12.— Find nine peas in a pod, put them over the door,
The first one that enters is yours evermore.

13.—It is bad luck to rock an empty cradle as the child to whom it belongs will soon die.

14.—In order that a dying man should die easily the windows of the room must be thrown open.

15.— Happy the bride the sun shines on,
Happy the corpse the rain rains on.

Variant. Lucky the bride that the sun shines on,
Blessed the corpse that the rain falls on.

16.—A big blue vein over the nose is a sign of a short life.

17.—The builder of a dwelling house dies before he can live in it a long while.

18.—If a dog howls at night it is a sign of death to some one near by ; a sick person will surely die. Some say the same of the screeching of a cat at night, especially if a woman be sick.

19.—To break a mirror or other object of glass is unlucky ; the former announces death.

20.—The fall of a mirror or of a picture announces death.

21.—It is unlucky to wear black if not in mourning; some relation will die, and give occasion to wear it.

22.—A wedding ring must never be taken off the finger when once put on.

23.—A baby's nails should never be cut, as it will make the child light-fingered.

24.—A corpse will bleed at the touch or in the presence of its murderer.

25.—Twins seldom both reach maturity.

26.—A six months' child can live; a seven months', never.

27.—Whoever is the possessor of a caul cannot be drowned. It is very lucky to be born with one; it should not be parted with.

28.—If two persons break the wishbone of a fowl, the one who gets the shortest end will be married the first.

29.—If one meets a white mule, and afterwards counts forty white horses, he or she will then meet the future spouse.

30.—It is unlucky to cross through the line of a funeral procession.

31.—The hooting of an owl presages death to one of those who hear it, within the year. To avoid the evil effects of the omen one of its hearers must take off a shoe and turn it over to counteract the bad augury.

32.—If four persons accidentally cross hands when shaking hands in taking leave, it is a sign of a marriage.

33.—If the wishbone of a fowl is placed over a door, the person who places it there will marry the first person of the opposite sex who enters under it.

34.—A child born on a Sunday will never lack for bread.

35.—If one sews with black thread on a white garment, the same needle will soon be used for the person's shroud.

36.—If one removes the skin of an apple whole and whirls it three times around the head with the left hand, it will assume, on falling, the initial letter of the name of one's destined spouse.

37.—It is unlucky to postpone a wedding.

Weather and Seasons.

(*a*)—*Celestial:*

1.— If Candlemas-day be bright and clear
There'll be two winters in the year.

2.—If it rains on Candlemas-day the winter is over; if clear it is but half done.

3.— If Candlemas-day is fair and bright,
Winter will take a rougher flight.

4.—Of a storm :

Long foretold, long last,
Soon come, soon past.

5.— A red sky in the morning is the sailor's warning,
A red sky at night is the sailor's delight.

6.—A halo around the moon denotes falling weather.

7.—The rainbow presages that the rain is over ; also that no other universal deluge will ever take place.

8.—When the new moon lies with its horns up, it is a sign of dry weather. If the horns are downturned, it is a sign of rain.

9.—It always rains Quaker meeting week.

10.— When the wind veers against the sun,
Trust it not, for back it will run.
When the wind is in the south
It is in the rain's mouth.

11.— Evening gray and morning red,
Traveler wise will keep his bed.

12.— If February gives much snow
A fine summer it doth foreshow.

13.— A rainbow in the morning is the sailor's warning,
A rainbow at night is the sailor's delight.

14.—If it rains when the sun is shining people say, "the devil is beating his wife."

(*b*)—*Terrestrial :*

1.—If the groundhog sees his shadow on the second of February, he goes back to his hole in the ground for another six weeks' doze, as he knows that the winter will endure so much longer ; *per contra*, if he cannot see it, he stays out, for he knows that the severe weather is past.

2.—When cats wash their faces it is a sign of rain.

3.—If the oak gets into leaf before the ash, the year will be a fine and productive one ; if contrary, it will be wet and backward.

4.—When a spider elongates his web it is a sign of fair weather ; when he shortens it, the weather is about to be stormy.

5.—If the Cicadas sing loud at nightfall 'tis a sign of a clear warm day to follow.

6.—A green Christmas predicts a fat churchyard.

7.—Fresh ant-hills presage pleasant weather.

8.—Cobwebs on the grass indicate a clear day.

9.—The croak of a tree-frog indicates rain.

10.—The cry of the "rainbird" or cuckoo presages rain.

11.—The weather of the ensuing winter can be known by inspection of the breastbone of a goose: it will be cold in proportion to the intensity of color of any dark spots that may be seen on its side.

12.—When smoke ascends it is a sign of fair weather: if it descends, of rain.

13.—The weather changes with the phases of the moon.

14.—When many crows gather together and chatter it is a sign of bad weather.

15.—If a cock crows at an unaccustomed hour of the night the weather is about to change.

16.—St. Patrick's day is expected to be stormy.

Folk Medicine.

1.—A wedding-ring rubbed on a sty will cure it.

2.—Fasting spittle will cure a sore eye.

3.—To cure a bite use a hair of the dog that caused it: it is sometimes placed between two slices of buttered bread and eaten as a sandwich.

4.—Anointing any instrument that caused a wound will heal it.

5.—If one sneezes seven times it will be a sure relief for a cold.

6.—It is best to sleep with the head towards the North.

7.—A horsechestnut carried in the pocket will cure piles.

8.—A potato carried in the trousers' pocket will cure the rheumatism.

9.—A horsechestnut carried in the pocket will bring good luck; by some persons it is carried as a cure for rheumatism.

10.—A cold key dropped down the back is a sure cure for a bleeding at the nose.

11.—Children can be cured of the whooping cough by inhaling the ammoniacal fumes at gas works.

12.—A cockroach stewed in sweet oil will relieve ear-ache if the decoction be poured in the ear.

13.—If a piece of bacon is rubbed on a wart and buried under a stone, the wart will disappear with the decaying meat.

14.—A pain in the side caused by fast walking can be cured by sitting on a stone by the wayside, after spitting beneath it.

15.—Hiccoughs can be cured by holding the breath until fifty are counted, during which time the end of one's finger must be intently regarded; at the end of that period a small spider will make its appearance on the tip of the finger.

16.—Seven sips of water will cure hiccoughs.

17.—A young person ought not to sleep with an older one, as it robs the younger one of its vitality.

18.—To wash the face with dew newly fallen on the first of May will remove freckles.

19.—The rays of the moon falling on the face of a sleeping person will produce nausea: some say, delirium or insanity.

20.—A piece of rope with which a person has been hung will cure by its touch fits, epilepsy, etc.

21.—Jaundice in children can be cured by giving them their own water to drink.

22.—Boys believe that by urinating on their limbs before going in to swim they can be protected against the cramp.

Signs and Omens, Portents and Superstitions.

1.—If one wears out a round hole in the centre of the sole of a shoe, it is a sign that one will want bread.

2.—It is lucky to touch a hunchback's hump.

3.—It is lucky to see three hunchbacks in succession in one walk.

4.—If a fire kindles quickly and briskly, one has a smart lover.

5.—If the bottom of a woman's gown is turned up at the back, it is a sign of a new dress. Also, that one's lover is thinking of her.

6.—If the soles of the feet itch, it is a sign of walking on strange ground.

7.—If the elbow or knee itches, it prognosticates a change of bed-fellow.

8.—If a piece of bread falls from one's hand, some one is coming a beg ging.

9.—If one takes a second piece of bread while the first is still uneaten, it is a sign that some one grudges it to you; *aliter*, some one is coming a begging.

10.—The air bubbles in a cup of tea, coffee, etc., denote money coming.

11.—Sparks flying towards one from a fire denote money coming.

12.—It is bad luck for a white cat or pigeon to come to a house.

13.—It is unlucky to dress one leg entirely before anything is put on the other.

14.—The left leg is always to be partly dressed first.

15.—Lucky at cards, unlucky in love, and *vice versa*.

16.—To find a spider or vermin on one's clothing, is a sign of good luck, generally money.

17.—One must always go out by the door one enters. Never go out of the back door if you have entered by the front, and *vice versa*. It is most unlucky. The idea here seems to be that of crossing or dividing the house.

18.—Hair and nails should be cut with the waxing moon.

19.—To sneeze three times before breakfast is the sign of a stranger.

20.—If one sings before breakfast he may cry before supper.

21.—Boys always spit on new clothes for good luck : they call the practice "wetting it."

22.—A present of a knife or other sharp-pointed instrument will cut friendship ; it is customary when receiving such a present to give a small coin in exchange.

23.—It is unlucky to pass under a rope or a ladder.

24.—It is bad luck to meet a cross eyed person on first leaving the house.

25.—It is unlucky ever to open an umbrella in a house.

26.—Friday is an unlucky day ; anything begun or done on that day will turn out badly.

27.—A new pocket-book should be given with some money in it.

28.—The first money received on a day is to be spat on for luck.

29.— If the nose itches it is a sign of danger,
Of seeing a fool, or kissing a stranger.

30.—A fire won't burn if the sun shines on it.

31.—If the right hand itches it is a sign of receiving money ; if the left, to pay it out.

32.—Clothing put on accidentally wrong side out signifies a piece of good luck ; in this case it must be so worn until night.

33.—To spend money on New Year's day before having received any, is a bad sign, as it foreshadows more outlay than income during the year.

34.—If the first person one meets on leaving the house on New Year's

day is a person of the opposite sex, it foretells good luck for the rest of the year; if of the same sex it is a bad omen.

35.—It is wrong to spit towards the sky.

36.—It is wrong to place a veil over the face, or to counterfeit death.

37.—One's bed must not be made up in such a manner that the feet are towards the door, as thus the dead are carried out.

38.—If two persons interlace their little fingers it will stop a dog from defecating and will oblige him to change the place which he has chosen for the performance.

39.—White spots in the nails indicate presents.

40.—If a horse hair be thrown into water it will become a snake.

41.—For every gray hair pulled out seven will come.

42.—Small ears are a sign of avarice; large, of generosity.

43.—Children who play with fire will wet the bed.

44.—Old maids are to lead apes in hell.

45.—If when about to say anything it is forgotten, it is a lie.

46.—If one falls upstairs, he or she will not be married during that year.

47.—It is lucky to have money in one's pockets when the new moon is first seen: it must be turned over several times for increase. If one has not money then, it is a bad omen.

48.—It is unlucky to destroy a swallow's nest.

49.—Speak of a person and one will hear from or see him or her.

50.—A black cat is considered especially unlucky by sailors.

51.—It is unlucky to point a loaded weapon at a person, as the devil loads them on such an occasion.

52.—The shell of an egg should always be broken into pieces, or else witches will use them to ride in.

53.—To spill salt is unlucky; the omen can be averted by three pinches of salt being thrown over the left shoulder.

54.—Once having gone out it is unlucky to return; in this case the ill-luck can be averted by taking a seat before making a fresh start. Some say you must sit down and cross your legs.

55.—If the right ear burns it is a sign that some one is speaking well of one; if the left, bad.

56.—Thirteen persons are unlucky at table or any other gathering, as one will die within the year.

57.—A horse shoe must be picked up, if seen in the street and brought home, and hung over a door for luck.

58.—Meat exposed to the light of the moon will spoil sooner than if exposed to the sun.

59.—There is a peculiar coldness in the rays of the moon.

60.—That there is a face in the full moon. Every one can see the face of his or her absent lover.

61.—Any wish formed during the shooting of a star will be fulfilled.

62.—That cats have nine lives.

63.—To keep a cat from running away from a strange house one must anoint its paws with butter.

64.—Hares sleep with their eyes open ; similarly weasels.

65. Children are told that to get behind a door and eat a piece of gristle will make the hair curl.

66.— A whistling woman and a crowing hen
Will never come to a good end.

67.—When one sneezes it is proper to say, "God bless you."

68.—One who looks in a mirror at night will see spirits looking over his shoulder.

69.—If two people by chance say the same thing at once, neither must speak till a wish has been formed.

70.—The wear of shoes :

Wear at the toe, live to see woe ;
Wear at the side, live to be a bride ;
Wear at the ball, live to spend all ;
Wear at the heel, live to save a deal.

Variant : Wear at the toe, pay as you go ;
Wear at the heel, pay a good deal ;
Wear at the ball, live to spend all.

71.— Sneeze on a Monday, you sneeze for danger ;
Sneeze on a Tuesday, you kiss a stranger ;
Sneeze on a Wednesday, you receive a letter ;
Sneeze on a Thursday, you'll get something better ;
Sneeze on a Friday, expect great sorrow ;
Sneeze on a Saturday, get a sweetheart to-morrow ;
Sneeze on a Sunday, your safety seek,
The devil will chase you the whole of the week.

72.— Cut your nails Monday, you cut them for news ;
Cut them on Tuesday, a pair of new shoes ;
Cut them on Wednesday, you cut them for health ;
Cut them on Thursday, 'twill add to your wealth ;

Cut them on Friday, you cut them for woe ;
Cut them on Saturday, a journey you'll go ;
Cut them on Sunday, you cut them for evil,
All the week long you'll be ruled by the devil.

73.—Children are told that to eat crust will make their legs fat : *aliter*, their hair curl.

74.—If the rays of the moon fall on the face of a sleeper, he can be made to answer any question truly and to reveal secrets.

75.—That if one meets a red-haired woman in the street, she will be immediately followed by a white horse. (This has only come into vogue in the United States within the past two years.)

76.—It is bad luck for a bird to fly into a room.

77.—Crops will only prosper when planted in the right sign of the moon.

78.—It is unlucky for a girl to give her lover a pair of slippers.

79.—To find a "measuring worm" on one's clothes indicates a new garment. Some say it is a sign of shroud.

80.—If a "W" appears on the back of the cicada (locust), it forebodes war ; if a "P" can be traced, it is a sign of peace.

81.—One who is going away in a carriage must never be looked after by those remaining in the house as it will bring the person bad luck.

82.—If threads are left unbasted in a garment it is a sign that it is not paid for.

83.—If a hair-pin falls, or a woman's skirt becomes loose or drops, it is a sign that one's absent lover is thinking of her : *aliter*, that he is false.

84.—If a fly buzzes persistently around a person it is a sign of news to come, or a stranger.

85.—If one forgets a glove, handkerchief, or other article by accident on leaving a room it is unlucky to return for it.

86.—A red dog is proverbially worthless ; equally so a yellow dog.

87.—Shoes and slippers when not in wear must be placed on the floor with their heels almost joining and the toes pointing outward at an acute angle.

88.—Letters should be torn up, never burned nor thrown away whole ; otherwise it is unlucky.

89.—It is very lucky to be followed in the street by any stray domestic animal.

90.—A horse with one or more white feet is considered more or less impaired in value :

Four white feet and a white nose—
Throw him to the crows.

91.—It is unlucky to part the fingers of any one with one's own hand; it betokens a violent quarrel.

92.—A hole in one's stocking signifies a letter in the post-office.

93.—It is extremely lucky to walk accidentally in ordure.

94.—If a bird should defecate on a person passing underneath it is a sign of great good luck.

95.—When the wick of the candle has grown long and sputters it is said to have a coffin in it.

96.—When a coal jumps out of a fire it is a sign of a stranger: *aliter*, of a coffin.

97.—A knife, fork, scissors, etc., falling on the floor and sticking upright is the sign of the coming of a stranger.

98.—If a knife falls on the floor without sticking up in it, it is a sign of a strange woman coming: if a fork, a man.

99.—Bread baked on a Sunday is never good.

100.—Dreams go by contraries.

101.—A dream told before breakfast is sure to come true.

102.—It is very lucky if the first person met on leaving the house in the morning be a negro.

103.— See a pin and pick it up,
All that day will have good luck:
See a pin and let it lay,
Bad luck sure for all that day.

104.—Moles on the flesh are signs of good portent.

105.—Hairy people are of strong constitution.

106.—It is unlucky to wear a black pin in one's clothes if not in mourning.

107.—It is unlucky to try on mourning clothes if not in mourning.

108.—Odd numbers are lucky.

109.—Midnight to one o'clock in the morning is the hour especially chosen for spirits to appear on earth.

110.—A person who drinks from the same vessel as another, if he puts his lips in the place where his predecessor drank from, will know all his secrets.

111.—When sparks fly from a candle it indicates the arrival of a letter: the direction towards which they go shows the quarter whence it may be expected.

112.—It is bad to drink water before seating oneself for a meal.

113.—A coin with a hole in it should be kept as a pocket piece for good luck.

114.—It is unlucky to eat in the street.

115.—It is unlucky to burn bread or other food.

116.—Children are told that if a dog should get one of their extracted teeth, they will get a dog's tooth in its place.

117.—Children are told that if they refrain from putting their tongue in the cavity from which a tooth has been extracted, that they will have in its place a *golden* tooth.

118.—To stop a dog from howling at night one's shoes must be turned upside down when the sound is heard.

119.—To find any lost article a key is placed in a Bible or large book, then fastened and held in such a manner that it can move. At the mention of the place where the lost article is, or the person who took it, the book will make a movement.

120.—It is very unlucky to stumble.

121.—It is unlucky to kill a lady bug.

122.—To kill a lady bug will produce a thunder storm.

NOTE.—According to the eminent scholar, D. Alejandro Guichot y Sierra, the following of the foregoing superstitions are likewise current in Andalusia :

Birth, Death and Marriage—Nos. 16, 17, 18, 19, 20 ; *Weather, Celestial* —Nos. 2, 6, 7, 8 ; *Weather, Terrestrial*—Nos. 2, 15 ; *Medicine*—Nos. 6, 16.

General Superstitions—Nos. 31, 32, 33, 35, 36, 37, 38, 39, 40, 41, 42, 43, 45, 51, 52, 55, 56, 62, 63, 64, 67, 68, 81, 88, 89, 109, 111, 112, 114.

The Classification and Nomenclature of Metalline Minerals.

By T. Sterry Hunt.

(*Read before the American Philosophical Society, May 4, 1888.*)

1. The writer in April, 1885, presented to the National Academy of Sciences the project of A Natural System in Mineralogy, which was farther elaborated in an essay before the Royal Society of Canada in May of the same year, published in Volume III of the Transactions of that Society, and with revisions and additions, in his Mineral Physiology and Physiog-

raphy in 1886 (pp. 279–401).* In this essay it was maintained that such a system cannot be established on the sensible characters of the species alone, as taught by the school of Mohs, nor yet on chemical composition and relations, to the neglect of such characters, in accordance with the views of the Berzelian school, or of those who propose a chemico-crystallographic scheme like that of Groth. It was the aim of the writer to show that the hardness, the specific gravity, and moreover the greater or less susceptibility to chemical change in species, are intimately related to chemical constitution; and that a natural system of classification, which, in the words of John Ray, "neither brings together dissimilar things, nor separates those which are nearly allied," must take into account all these various characters and relations, alike dynamical and physical. The error of attaching an undue importance to a single subordinate character is illustrated in the case of crystalline form, which may vary, while specific gravity, hardness, color, lustre and chemical composition all alike remain unchanged, as seen, for example, in the native sulphids of zinc and of silver.

In pursuance of these ideas, the whole inorganic kingdom was declared to belong to Mineralogy, although as a branch of Natural History it is generally confined to native species. The real position of mineralogy, as distinguished under its various heads of Systematic, Descriptive and Physiological Mineralogy, is set forth in the following tabular view of the natural sciences, copied, with slight revision, from the volume just cited.

			Inorganic Nature.	Organic Nature.
Natural Sciences.	Descriptive. — *General Physiography or Natural History.*		Mineral Physiography. — Astronomy, descriptive. Mineralogy, descriptive and systematic. Geognosy. Geography.	Biophysiography. — Organography. Botany and Zoölogy, descriptive and systematic.
	Rational. — *General Physiology or Natural Philosophy.*		Mineral Physiology. — *Dynamics. Chemistry.* Astronomy, theoretical. Mineralogy, physiological. Geogenesis.	Biophysiology. — *Biotics.* Organogenesis. Morphology. Botany and Zoölogy, physiological.

2. The classification then proposed by the writer, divides the mineral

*See also, Supplement to A Natural System of Mineralogy, Trans. Roy. Soc. Can. for 1886, Vol. iv, Part 3.

kingdom into four classes, namely: I, *Metalline;* II, *Oxydized;* III, *Haloid,* and IV, *Pyricaustate* (combustible or fire-making) species. These again are divided into orders, and in some cases into suborders, as was set forth on page 382 of the already cited volume. In the large and important order of the SILICATES, the only one then considered in detail, there was recognized in each one of its three suborders of Protosilicates, Protopersilicates and Persilicates—five tribes, designated Hydrospathoid, Spathoid, Adamantoid, Phylloid and Colloid (or Porodic); called, in some cases, by other more distinctive synonyms, as Pectolitoid, Zeolitoid, Ophitoid and Argilloid; in farther extension of which, we may say Amphiboloid, Feldspathoid, Granatoid, Topazoid, Talcoid, Micoid, etc., for the other tribes. The characteristic species of these tribes were then critically examined as regards chemical composition and the relations of this to specific gravity and to hardness. These relations were shown in separate tables for the various tribes, and farther in three synoptical tables of the suborder (*loc.cit.*, pp. 399-401). The order of the OXYDATES (included, like the last, in the class of the OXYDACEÆ) was, at the same time, more briefly considered, and shown to include representatives of five similar tribes (p. 376). In various orders of the same class, such as CARBONATES and BORATES, as likewise in the suborders of the HALOIDACEÆ, such as CHLORIDS, the soluble and sapid species were recognized as forming tribes—Carbosalinoid, Borosalinoid and Chlorosalinoid—contrary to the teaching of Mohs and his followers, who made these characters the basis of a class-distinction. It should be added that the species of all these various tribes have farther to be arranged in genera, and, to complete the system, require a binomial Latin nomenclature.

3. In the study of the various species of the order of Silicates, notice was, in every case, taken not only of the specific gravity of the species, but of the relations between this and its equivalent or so called molecular weight, as shown in what is generally known as its atomic volume, calculated by the formula, $p \div d = v$. For the purpose of thus comparing related species it was necessary to fix a simple unit for p. As we have since said, in the study of the species of Classes II and III: "We assume as the unit for p a weight including that of $H = 1.0$, of $Cl. = 35.5$, or of $O \div 2 = 8.0$. By thus adopting a combining weight of 8.0 for oxygen, as a basis, we get a unit which gives a common term of comparison for oxyds, sulphids, chlorids, fluorids, and for intermediate compounds like the oxysulphids and oxyfluorids common in native species. It is, of course, a hypothetical unit, which, for elemental species, and for fluorids, chlorids, etc., corresponds with the normal vaporous species; but for oxydized species is some fraction thereof, as in the cases of water-vapor, H_2O, of spinels, and other oxyds.

"We may readily extend this system of hypothetical units from silicates to carbonates, sulphates, phosphates, and more complex species, by dividing in all cases the empirical equivalent weight by twice the number

of oxygen portions (O = 16.0), plus the number of chlorine or fluorine portions. We have for example :—

		p.
Forsterite.....	$SiMg_2O_4 = 140 \div 8$.....	17.50
Calcite.....	$CCaO_3 = 100 \div 6$.....	16.66
Karstenite.....	$SCaO_4 = 136 \div 8$.....	17.00
Gypsum	$SCaO_4.2(H_2O) = 172 \div 12$.....	14.33
Apatite.....	$3(P_2Ca_3O_8).CaF_2 = 908 \div 50$.....	18.16

"In the writer's late essay on A Natural System in Mineralogy, the values of *p* have been thus determined. These silicates are there represented by a new notation, which employs symbols in small letters to represent quantivalent ratios ; the combining weights of the elements being divided by their valency, and in all cases followed by their coefficients. The formula of forsterite thus becomes $(mg_1si_1)o_2$, that of orthoclase, $(k_1al_3si_{12})o_{16}$, and that of topaz, $(al_3si_2)o_4f_1$.

"While a similar unit is equally applicable to all haloid species, it has been found more convenient for the metalline species which constitute Class I, including unoxydized metals and their compounds with one another and with arsenic, antimony, sulphur, selenium and tellurium to divide the formula by the sum of the valencies therein represented ; so that for all such species the unit *p* gives not the mean integral weight of an oxygen compound in which O = 8, but that of the element, corresponding to S = 16, to Fe = 28, to Ag = 108, to As = 25, Sb = 40, and Bi = 69.3,"* represented respectively by s_1, fe_1, ag_1, as_1, sb_1, bi_1.

4. The law of condensation and of expansion by volumes, familiarly known in the chemistry of gases and vapors at ordinary pressures, is, as the writer has endeavored to show, still further exemplified in the case of the very dense vapors into which, under much greater pressures, liquids like water, alcohol, hydrocarbons, and theoretically, all chemically stable liquids, pass when heated sufficiently ; that is to say above their so-called critical points, when they necessarily assume the vaporous condition. The conversion of all gases and vapors, by reduction of temperature and augmentation of pressure, into liquid and solid forms, helps us to understand that the same laws of combination by weight, and of condensation or integration of volume, apply alike to gases and vapors on the one hand, and to liquids and solids on the other. The relation of condensation (represented by specific gravity) to equivalent weight, which thus becomes a fact of fundamental importance, is shown by comparing the quotient got by dividing the received equivalent (so called atomic or molecular) weight by the specific gravity of the body, as determined for all liquid and solid species, taking water as unity, as in the formula $p \div d = v$. The equivalent weight *p* is, as we have seen, that deduced from the empirical chemical formula calculated from hydrogen as unity.

* A New Basis for Chemistry, 2d Edition, § 139 ; also the author on Chemical Integration, *American Journal of Science*, August, 1887.

Thus hydrogen being 1 = H, the equivalent weight of carbon dinoxyd, whether as gas, liquid or solid is assumed as 44 = CO_2; that of water in any of its states is taken as 17.96 = H_2O, and that of the various forms of silica as 60 = SiO_2; while that of carbonate of lime, whether as calcite or aragonite, is 100 = $CCaO_3$. These weights in the case of gaseous bodies are really the weights of equal volumes, compared with that of hydrogen at the same temperature and pressure, and are truly equivalent weights. The law of condensation, however, shows us that in the case of liquid and solid species we have to deal with much more complex formulas than these. In fact, the minimum equivalent weights deduced from analyses of the chlorids of the ammonio-cobalt bases give numbers of 500 and upwards, and in the case of a certain metaphosphate, equal 2,540. The complex potassio-cobaltic nitrite is represented by a formula giving an equivalent weight of not less than 958. These weights are surpassed by those deduced for the complex silicotungstates, and phosphotungstates, our knowledge of which has been much extended by the late researches of Wolcott Gibbs on what he has called "the complex inorganic acids." Therein he has made known the existence of progressive or homologous series, the successive terms of which differ by $2WO_3$, and rise from $4WO_3$ to $24WO_3$, and even $60WO_3$; having formulas from which the minimum molecular weights deduced are represented by many thousands, H = 1. Thus the golden insoluble crystalline compound of tungsten, oxygen and sodium described by Wöbler is probably, according to Gibbs, $16WO_3.\ 4WO_2.\ 7Na_2O$ = 5,002., while to another crystalline species, soluble in water, and hydrous, he ascribes the formula,

$$60WO_3.\ 3P_2O_5.\ 2V_2O_5.\ VO_2.\ 18BaO + 144H_2O = 20,058.$$

This, according to him, has "the highest molecular weight yet observed." The studies of Gibbs and of many others, whose work in this field has been briefly summarized by the writer (Mineral Physiology, etc., pp. 386–389), unite in showing that a great complexity of composition may exist in definite crystalline compounds, and moreover that very small portions of different substances may not only occur as necessary elements in such a compound, but may even change essentially its chemical relations. Thus in a complex tungstate containing $12WO_3$ = 2784, the addition of SiO_2 = 60, suffices to determine the production of a new type, with changed basicity. In like manner the addition to a compound containing $24WO_3$ = 5568, of P_2O_5 = 142, gives a new and distinct acid type. Moreover, oxygen in these bodies may be in part replaced by fluorine; while platinum, selenium, tellurium and many other elements may enter in small but definite amounts into the polytungstates and polymolybdates, as well as organic radicles, such as methyl, ethyl and phenyl. These remarkable results are regarded by Gibbs as forming "a new department of inorganic chemistry." In commenting upon them, however, it has been elsewhere said:

"It will be remembered that I had already, in 1853, proclaimed that

the whole chemistry of solids and liquids is only intelligible when regarded as a history of just such complex inorganic acids and salts; that the distinction between organic and inorganic chemistry is no longer tenable; that the same principles of homology and polymerism are applicable alike to the bodies of the carbon series and the silicon series; that the native crystalline carbonates, or carbon-spars, are polycarbonates, with equivalent weights of not less than from 1500 to 2500; that the pyroxenes, feldspars, and tourmalines are polysilicates of equally complex constitution, and are represented by formulas which show the existence among them both of polymers, probably homologous, and of anisomeric homologues. These conceptions, all of which were explicitly set forth and defended in 1852 and 1853, underlie the writer's philosophy of the mineral kingdom, as then enunciated, and as persistently maintained to the present date."*

5. It was not, however, until a much later date that a farther attempt was made to fix the *integral weight*, as I have designated the so-called molecular weight of solid species. By extending to such species the law of equivalent volumes, the conclusion was reached that their integral weights were even far greater than had been suspected by the writer in 1853. In fact, that of water itself, the unit of specific gravity for liquids and solids, being in round numbers 21,400,† the weights for these various species must be as much greater as their specific gravities are higher than this unit. We thus find that the solid forms of carbon dinoxyd and silicon dinoxyd, of carbonate of lime, and even of the ammonia-cobalt salts, and the highest members of the polytungstate series, represent in all cases polymeric or condensed derivatives of the normal species; which is for the most part unknown, or appears, as in the case of CO_2 and H_2O, in a gaseous form. A species like calcite of specific gravity 2.729, is represented by $584CCaO_3$ or by $C_{584}Ca_{584}O_{1752} = 58,400$. In like manner other mineral species must be represented by formulas more complex, and weights far higher, than those deduced by Gibbs for his polytungstates. In the case of such compounds, partial substitutions and small additions, affecting but slightly the centesimal composition of a species, may nevertheless be essential to its chemical constitution, as shown by Gibbs in the cases of silicic and phosphoric oxyds added to the polytungstates. In the formula above assigned to calcite, with Ca_{584}, the substitution of Mg_{10}, would introduce into the species only 0.72 of magnesia. Such substitutions and

* A New Basis for Chemistry, 1887, § 27.

† In liquid water 1192 volumes of water-vapor at standard temperature and pressure are condensed into a single volume, which if $H_2O = 17.96$ gives an integral weight of 21,408; but in view of the uncertainty still prevailing as to the precise weight of oxygen, hydrogen being unity, the number 21,400 is adopted as a close approximation. In former publications by the writer, by an error in calculation, instead of $1192H_2O$ the formula of water has been given as $1628H_2O$, which with $H_2O = 17.9633$, gave an integral weight of 29,244. This mistake was corrected in a note on The Integral Weight of Water, in the *L. E. and D. Philos. Magazine*, for April, and in the *American Journal of Science*, for May, 1888. See also the author's New Basis for Chemistry, 2d Edition, *passim*.

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small additions would, however, if found in ordinary analyses of mineral species, be disregarded, as impurities not essential to the composition. In like manner the small amounts of fluorine, of chlorine, of hydrogen, of boron, and of phosphorus, so often met with in native silicates, are not to be looked on as accidental ingredients, but as essential parts of highly complex integers. Farther and more critical chemical analyses are necessary before we can fully know the constitution of dense insoluble species, and the great difficulty is to decide how far these small portions of elements are due to impurities, and how far they are elements necessary to the constitution of the species; questions which in many cases can only be solved by much care and study.

6. The non-oxydized metalline minerals, embracing the metals, their alloys, and all their compounds with sulphur, selenium, tellurium, phosphorus, arsenic, antimony and bismuth, are, in the natural-historical classification of Mohs and his followers, comprised in four orders—Pyrites, Metals, Glances and Blendes (Pyrites, Metalli, Lamprites and Minia of Breithaupt). All of these we have included in Class I, METALLACEÆ, embracing but a single order METALLATA, which is, however, divided into two suborders. The reasons for including the metals and their various alloys in the same order with sulphids, selenids, tellurids, phosphids, arsenids, antimonids, bismuthids, sulpharsenids, sulphantimonids, etc., are two-fold; first, the resemblances between the typical and malleable metals, such as gold, silver, lead, copper, nickel, and iron, and the elementary metalline species, tellurium, arsenic, antimony, and bismuth, are such that the compounds of these with the metals above named cannot well be separated from alloys. Another reason is to be found in the complex nature of many artificial products known to us as metals. Thus the cast irons from the blast-furnace are compounds, apparently homogeneous, of iron with small quantities of sulphur or of phosphorus, with silicon, and with carbon; while copper may in like manner contain small quantities of phosphorus, of arsenic, or of silicon. These constitute sulphids, phosphids, arsenids, silicids and carbids of iron and of copper, in which the amounts of the added elements, though proportionally small, nevertheless, modify profoundly the character of the compounds, affording additional illustrations of the principle insisted upon above in speaking of oxydized species.

7. The division of the Metallata into two suborders, which we have designated Metallometallinea and Spatometallinea, is based upon the radical differences which distinguish the great groups of the Glances and the Blendes. The first suborder, like the Glances, includes alike simple sulphids like galena, argentite, chalcocite, metacinnabar, stibnite and molybdenite; selenids like eucairite and clausthalite; tellurids like altaite, sylvanite and tetradymite; sulpharsenids like enargite; sulphantimonids like bournonite and stephanites; ulphobismuthids like emplectite and kobellite. To the Metallometallineæ also belongs the order Pyrites of Mohs. This not only includes the harder simple sulphids as marcasite, pyrite, siegen-

ite and laurite, and as pyrrhotite, chalcopyrite and millerite ; but arsenids such as smaltite, leucopyrite and niccolite ; antimonids like breithauptite, horsfordite and dyscrasite ; sulpharsenids like arsenopyrite and cobaltite ; sulphantimonids like ullmannite ; and sulphobismuthids like grunauite. In this same suborder, for reasons already given, belong the metals and alloys, including metallic arsenic, antimony and bismuth, and also the metallic forms of selenium and of phosphorus.

In the second suborder the metals are not represented by any known species, but by the non-metallic forms of selenium and phosphorus, and by the various modifications of sulphur. This suborder includes, moreover, simple sulphids like sphalerite, wurtzite, greenockite, hauerite, oldhamite, cinnabar and realgar ; sulpharsenids like proustite and tennantite ; and sulphantimonids like pyrargyrite and miargyrite. The opacity and lustre of the compound species of the first suborder, and their occasionally sectile character, connect them closely with the typical metals. On the other hand, the transparency, the absence of metallic lustre and aspect from the species of the second suborder recall the physical characters of oxyds like zincite, cuprite and senarmontite, with which they are connected through the oxysulphids, voltzite and kermesite. It is to recall these resemblances to the sparry Oxydates that we have called this suborder, Spatometallinea. It is worthy of note that not only the elements selenium and phosphorus, but the sulphids of mercury and of antimony are found in two distinct specific forms, and belong to both of these suborders ; and there seems some reason to believe that under the head of fahlerz or gray copper may be included, besides the species belonging to the Spatometallineæ, others which pertain to the Metallometallineæ.

8. In proceeding to divide into tribes and genera the various groups of species indicated in the preceding review of the order of Metallata, we are guided alike by the composition, as shown by chemical analysis, and by the physical characters of hardness and condensation. The latter, as indicated by the value of v, calculated for the elemental unit as already defined (§ 3), is the reciprocal of the coefficient of condensation. This value will be seen to diminish with the increase of hardness of the species, as represented by degrees given on the scale of Mohs, in which the hardness $=$ H $=$ 1.0 . . . . 10.0.

In fixing the value of p for those metals which like iron and chromium, like copper, mercury, gold, tin, palladium and platinum, yield two distinct chlorids, we have in all cases taken the amount of metal which, in the ferrous, chromous, cuprous, aurous, stannous, palladous and platinous compounds, is combined with one portion (35.5 parts) of chlorine. A similar rule, as already shown (§ 3), is applied in the case of arsenic, antimony and bismuth. This unit-weight of the metal $= p$, when divided by d—the specific gravity, water $=$ 1.000—gives the value of v.

(1.) The metals and their alloys, which we include in the tribe of the Metalloideæ, present, unlike the other tribes of the order, wide differences

in hardness, condensation, fusibility and chemical characters, which can now only be briefly noticed. Of the hard and less fusible metals, chromium, manganese, iron, nickel and cobalt with $p = 26—29.5$, give values for $v = 3.4 — 3.6$; while the denser group of palladium, rhodium and ruthenium, with $p = 52 — 53$, and also the still heavier group of platinum, iridium and osmium, in which $p = 97 — 99$, agree in having $v = 4.5 — 4.6$. The softer and more fusible metals, gold and silver, give $v = 10 — 10.5$.; the value of v for solid mercury being 13.9, for lead 9.2, for tin 8.0, and for cadmium, copper and magnesium 6.5 — 6.9. With these it is instructive to compare the values of v for the alkali metals, cæsium = 70, rubidium = 56, potassium = 44, sodium = 24, and lithium = 12; as also barium, strontium and calcium, in which v is from 12.5 to 17.5.

(2.) The tribe of the Galenoideæ is conveniently divided into the three subtribes of sulphids, selenids and tellurids, which we designate Thiogalenoideæ, Selenogalenoideæ and Tellurogalenoideæ. Of these, the first includes the typical genus Thionites, embracing the native sulphids of lead, silver and copper, together with metacinnabar, stibnite and bismutite; having $H = 2 — 3$; $v = 7 — 8$. The subtribe of the Selenogalenoids includes a genus which may be called Eucairites, embracing besides eucairite (cuproso-argentic selenid) various other selenids of lead, silver, copper, mercury and bismuth; $H = 2 — 3$; $v = 8 — 9.5$. The subtribe of Tellurogalenoids includes various tellurids of silver, gold, lead, mercury, nickel and bismuth, with $H = 2.5 — 3.5$; $v = 8 — 10.5$; which we include in the genus Tellurites. The soft flexible foliated sulphids like sternbergite, argyropyrite, friesite, covelline, and perhaps molybdenite, may constitute a second genus of the first subtribe, with the name of Thiophyllites; while tetradymite and nagyagite perhaps may form a similar division of the Tellurgalenoids, as Tellurophyllites.

(3.) In the third tribe we include many sulphids which are near in hardness, in condensation, and in other characters, to the last, and are chiefly sulphids of lead, copper and silver united with sulphid of antimony, of bismuth, or more rarely of arsenic. The antimonial species of this tribe are represented by the well-known species, bournonite; from which the name of the tribe, Bournonoideæ, and the genus Bournonites; having $H = 2 — 3.5$; $v = 7— 8.5$. The large group of bismuthic species, having similar values for H and v, and many other points of resemblance, of which emplectite is a representative, constitute the genus Emplectites. These two genera present instructive examples of progressive series, especially in the double sulphids of antimony and lead, Sb_2S_3. nPbS in which n has values of 1, 2, 3, 4, 5, 6, and, in a related species, even equals 12. The species enargite is an arsenical bournonoid, and to this tribe may perhaps belong some of the forms of fahlerz or gray copper ore.

(4.) The next three tribes are distinguished from the two preceding—which correspond to the Glances of the natural-history system—by their much greater hardness and condensation, and were included in the order

Pyrites of the same system, but are here divided on chemical grounds. The tribe of the Pyritoideæ may be divided into two genera, the harder designated as Pyrites with H = 5.5 — 6 ; v = 3.8 — 4.5, includes cubic and prismatic iron pyrites, with linnæite, siegenite, carrolite and laurite ; while the genus Pyritinus, H = 3.5 — 4.0 ; v 4.5 — 5.5, embraces troilite, pyrrhotite, allabandite, millerite, pentlandite, chalcopyrite, cubanite, and probably stannipyrite.

(5.) The tribe of Smaltoideæ includes the various arsenids of cobalt, nickel, and iron, of which leucopyrite and smaltite are representatives, and which we have included in the genus Smaltites, with H = 5 — 6; v = 3.6 — 4.5. The arsenids of copper, with less hardness and a higher value for v, will form a distinct genus, Algodonites. Closely related to Smaltites is the antimonial species, breithauptite ; while the antimonid of copper, horsfordite, and apparently dyscrasite, are near to Algodonites.

(6.) The tribe of Arsenopyritoideæ, embracing the genus Arsenopyrites, includes the compounds of sulphid of arsenic with sulphids of iron, cobalt and nickel, of which arsenopyrite or mispickel is a type, H = 5 — 6 ; v = 2.9 — 3.5. Near to these are some little known double sulphids holding antimony and bismuth, as ullmannite, corynite, alloclasite and grunauite.

(7.) Passing now to the suborder Spatometallinea, we have in the tribe Spatometalloideæ those forms of phosphorus and of selenium which are wanting in the metallic characters, including the colorless and the ordinary red phosphorus, apparently two forms of selenium, and the various known species of sulphur.

(8.) The tribe Sphaleroideæ includes the genus Sphalerites, embracing sphalerite, wurtzite, christophite, greenockite, hauerite, oldhamite, and cinnabar, having H = 2.5 — 4.0; v = 6 — 7. Here also belong the red antimony sulphid, metastibnite,* and the arsenical sulphids, realgar and orpiment.

(9.) The tribe Proustoideæ includes the genus Pyrargyrites, under which we may include, in two subgenera, both the arsenical and the antimonial red silver ores, including proustite, pyrargyrite, miargyrite, etc.; with H = 2 — 3 ; v = 8 — 9. In this tribe also are included the arsenical and the antimonial forms of fahlerz as members of a genus, Tennantites, in which moreover are placed, binnite, dufrenoysite, livingstonite, etc., having H = 3.5 — 4.5 ; v = 6.5 — 7.5.

The following table gives a synoptical view of the tribes and genera above proposed for the order of the Metallata. Further studies may probably show reasons for further subdivision of some of these genera, and for the establishment of new ones.

* The native red sulphid of antimony, Sb_2S_3, occurs abundantly as an amorphous deposit from thermal alkaline sulphurous waters, with sulphids of arsenic and cinnabar, at Steamboat Springs, Washoe county, Nevada, according to a private communication from Dr. G. F. Becker, who suggests the name of metastibnite.

Order METALLATA.

Suborder A. METALLOMETALLINEÆ.

Tribe 1. METALLOIDEÆ (Metals, alloys, metallic Se and P).
" 2. GALENOIDEÆ, including three subtribes :
a. Thiogalenoideæ ; Thionites, Thiophyllites.
b. Selenogalenoideæ ; Eucairites.
c. Tellurogalenoideæ ; Tellurites, Tellurophyllites.
" 3. BOURNONOIDEÆ ; Bournonites, Emplectites.
" 4. PYRITOIDEÆ ; Pyrites, Pyritinus.
" 5. SMALTOIDEÆ ; Smaltites, Algodonites.
" 6. ARSENOPYRITOIDEÆ ; Arsenopyrites.

Suborder B. SPATOMETALLINEÆ.

Tribe 7. SPATOMETALLOIDEÆ (Sulphur, non-metallic Se and P).
" 8. SPHALEROIDEÆ ; Sphalerites.
" 9. PROUSTOIDEÆ ; Pyrargyrites, Tennantites.

The writer has prepared tables, giving for each species in the order of the Metallata besides hardness, specific gravity and crystalline system, the chemical formula, represented by a simplified notation, as indicated in § 3, together with the unit-value for p, and the value of v calculated therefrom. For each species moreover, besides its trivial designation, are given its generic and specific Latin names. Thus, for example, we have for the species above named under the genus Pyrites ; P. cubicus, P. prismaticus, P. cobalteus, P. niccolocobalteus, P. cuprocobalteus and P. rutheneus ; while the named species of Pyritinus are ; P. ferrosus, P. magneticus, P. manganeus, P. niccoleus, P. ferroniccoleus, P. cupreus, P. subcupreus and P. stanneus. Again, the above-named species of the genus Sphalerites are ; S. zinceus vulgaris, S. zinceus hexagonus, S. ferrozinceus, S. manganeus, S. calcareus, S. mercureus and S. stibeus. A similar task, except so far as regards generic and specific names, has already been accomplished for the order of the Silicates in the essay published in 1886, already cited, and is now well advanced for most of the other orders. When completed, the whole will be published with explanatory and critical details, as a Systematic Mineralogy, to be followed by a Descriptive Mineralogy.

Sur deux espéces nouvelles des Ophidiens de Mexique.

Par Alfredo Dugés.

(*Read before the American Philosophical Society, May 4, 1888.*)

ERYTHROLAMPRUS GRAMMOPHRYS A. Dugés.

Ce petit Ophidien me paraît être un opistoglyphe, autant que j'en puis juger par le maxillaire supérieur dont les dents postérieures, bien séparées des antérieures, sont cassées à la base : les outres dents sont relativement courtes et assez longues. Au premièr aspect on pense à une Rhadinæa ou à un Liophis, mais cet individu n'a pas les dents égales comme la premierè, ni un pore aux ècailles comme le dernièr. En le jugeant d'après mes dessins, le Prof. E. D. Cope là comparé á *Erythrolamprus fissidens* Günth., mais celui-à a au moins 19 rangs d'écailles et 8 labiales supérieures, dont les 4ème et 5ème touchent l'œìl ; sa coloration est différente.

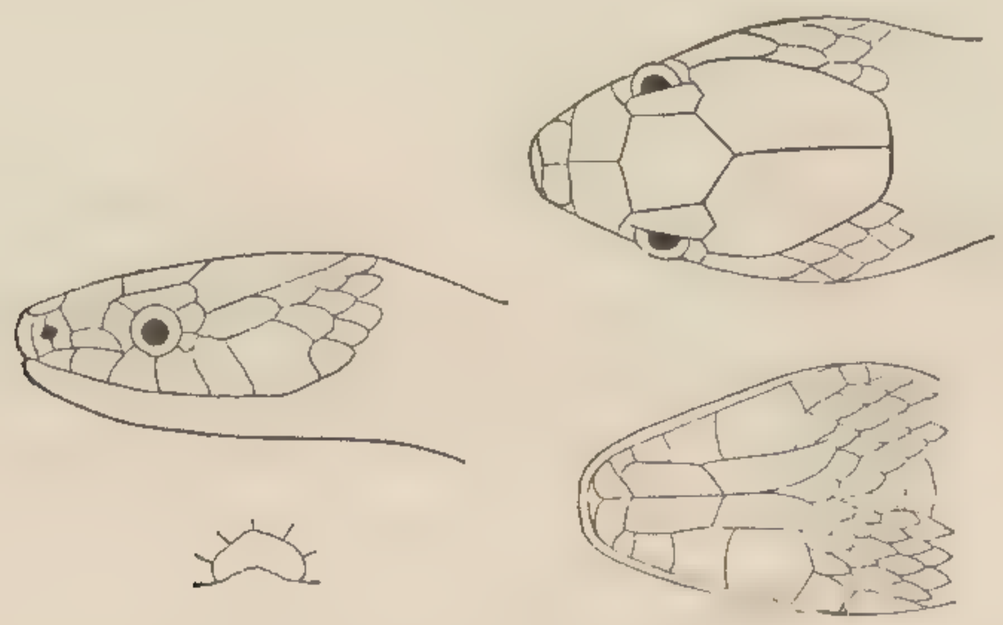

FIG. 1.—*Erythrolamprus grammophrys* Dugés.

Ecailles sans pores, lisses, rhomboïdales, un peu plus grandes sur les flancs, et d'un luisant comme huileux. En regardant de profil, ou voít une petite portion des gastrostéges. Ventre un peu aplati, mais le tronc légerèment comprimé quoiqu'il paraisse cylindrique au premier abord. Canthus rostralis plat. Les 9 plaques céphaliques ordinàires avec les caractères qu'elles ont chez les érythrolampres : rostrale non saillante : deux nasales avec la narine entre les deux : une frénale allongée horizontalement et touchant en haut à la 2ème prèfrontale qui est rabattue sur les côtés à angle mousse : une pré- et 2 postoculaires : temporales $1 + 2 = 3$: sept suslabiales, les 3ème et 4ème sous l'œìl, la sixieme plus grande : préoculaire étroite en bas : rostrale arrondie en haut, plus large que haute, non rabattue sur le museau : 8 sous-labìales : 4 sous-maxillaires allongées, les deux postérieures écartées à leur extrémité ; 5 sous-labiales en contact avec elles. Ou compte au milieu du corps 17 rangs d'écailles ; 175 gastrostegès ; anale double ; 41 urostegès doubles? (l'éxtremité de la queue est un peu tronquée.)

Longueur de la tête, $0^m,013$: largeur, $0^m,008$.

Milieu du corps : hauteur $0^m,0075$; largeur $0^m,007$.

Corps avec la tête, long: 0m,30; queue : 0m,06 (probablement 0m,075.)

Coloration. Dos brun ardoisé. Flancs brun-roux. Dessous du corps jaunâtre sans taches. Dessous de la tête blanc jaunâtre finement pointillé de gris clair surtout en dehors des gulaires. Une ligne blanche interrompue commence au bord externe des internasales, passe en haut de la portion rabattue des préfrontales, traverse l'angle supérieur des preòculaires, les post oculaires supérièures, l'angle antéroexterne des pariétales et termine à la partie postèrosupérieur des premierès temporales. Les labiales supérieures et la rostrale sont grisâtres dans leur moitie inférieure er brunes en haut, les deux couleurs étant séparées par une ligne blanche au dessous de laquelle le gris est plus foncé. Sur les flancs on distingue assez vagues ment une bande brune longitudinale qui, par places, paraît formée de troi lignes. Patrie : Tengohecho, Etat de Michoacán.

HEMIGENIUS VARIABILIS Alf. Dugés.

Ce petit serpent a des grands rapports avec la Storeria Bd. et Girard mais il n'a qu'une paire des plaques mentonniéres et une plaque loreale, charactéres sur lesquelles je propose d'etablir le genre nouveau Hemigenius.

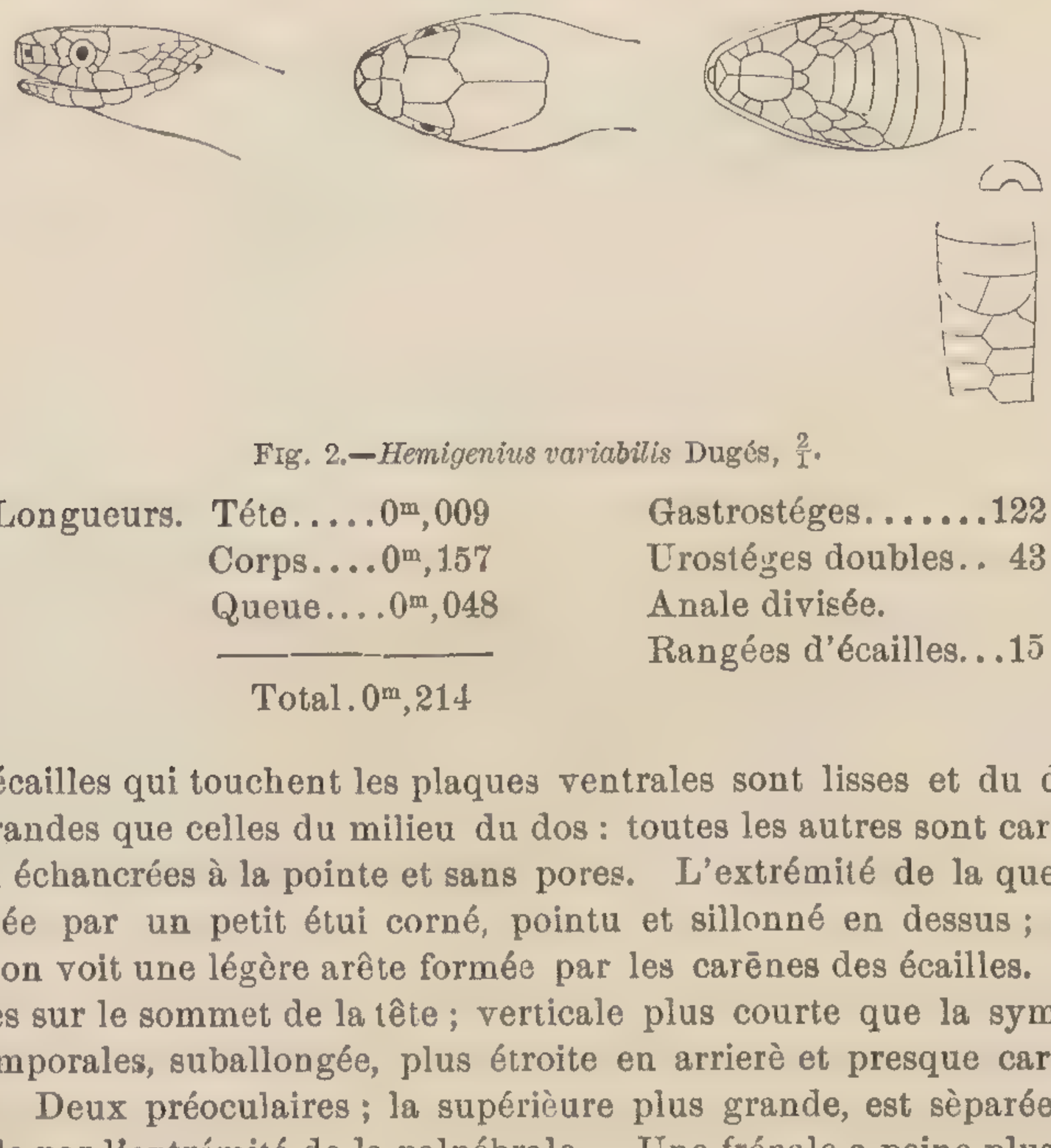

FIG. 2.—*Hemigenius variabilis* Dugés, $\frac{2}{1}$.

Longueurs.	Téte.....0m,009	Gastrostéges.....122
	Corps....0m,157	Urostéges doubles.. 43
	Queue....0m,048	Anale divisée.
	Total.0m,214	Rangées d'écailles...15

Les écailles qui touchent les plaques ventrales sont lisses et du double plus grandes que celles du milieu du dos : toutes les autres sont carênées, un peu échancrées à la pointe et sans pores. L'extrémité de la queue est emboitée par un petit étui corné, pointu et sillonné en dessus ; sur la queue on voit une légère arête formée par les carènes des écailles. Neuf plaques sur le sommet de la tête ; verticale plus courte que la symphyse des temporales, suballongée, plus étroite en arrierè et presque carrée en avant. Deux préoculaires ; la supérièure plus grande, est sèparée de la frontale par l'extrémité de la palpébrale. Une frénale a peine plus haute que large. Nasale double ; la narine ouverte à la partie postérieure de la premiére. Rostrale plus large que haute, triangle à angles arrondis et

échancrée en bas. Deux post-oculairès. Une grande temporale suivi de trois ou quatre petites. Sept labiales supérieures dont le 3ème es 4ème touchent l'œil et les 5ème et 6ème la grande temporale. Sept labiales inférieures : les deux premières se touchent sur la ligne médiane, de sorte que les premières sous-maxillaires ne touchent pas la mentonnière. Il y a cinque labiales en contact avec les sous-maxillaires : celles-ci sont au nombre de 4, les deux premières grandes, les autres plus petites et sèparées entre elles par une ou deux gulairès, les dernierès varient, car tantôt il n'y en a qu' úne, tantôt il y en a un assez grand nombre.

La tête est peu distincte du corps ; le museau arondi ; l'œil assez grand, la pupille ronde.

La langue est noire, l'iris rouge. La couleur générale varie du brun jaunãtre au rouge brìque sur les parties supérieures avec une étroite ligne médiodorsale plus pãle et limitée sur les côtes par deux lignes longitudinales formées de points noìrãtres. La gorge est blanche et le dessous du corps varie du rouge brìque au blanc jaunãtre. Entre les écailles la peau est jaune. Les tempes sont d'un brun pãle. Sur la tête, et dèpassant un peu les pariétales il y a une large tache marron, cardìforme en arrière où elle est plus foncée et comme divisée par une ligne mediane claire qui s ávance entre les pariétales. Sur les extrémités des gastrostéges il y a un nuage de trés-petits points grisãtres.

Un autre individu d'un brun cannelle en dessus porte le long du dos un grande nombre de petites raiès transversales formées de points bruns et accompagnées sur les flancs par de petites taches verticales de la même apparence : la ligne dorsale pãle est à peïne visible.

J'ai trouvé ce petit serpent à la Barranca de Portillo (Guadalajara) et aussi à Guanajuato. Il est tout-á-fait inoffensif.

Ibrâhim Nukić. Ein Guslarenlied der Mohammedanischen Slaven in der Hercegovina.

Von Dr. Friedrich S. Krauss (Vienna).

(*Read before the American Philosophical Society, September 7, 1888.*)

Wer slavisches Wesen erkunden will, geht irre, falls er die s. g. altslavische Literatur und vielleicht zur Ergänzung die modernen slavischen Kunstliteraturen durchstöbert. Jene bietet ihm nichts dar als häufig ganz wertlose Uebersetzungen der hl. Schriften des alten und neuen Testamentes und unsäglich naive Heiligenlegenden, die Kunstliteratur der Slaven weist dagegen vorwiegend Nachbildungen abendländischer Muster auf. Erst in neuerer Zeit hat man als die richtige Quelle der Erkenntniss slavischen Wesens das slavische Volkstum erkannt. Die Culturzustände der Slaven überhaupt, insbesondere aber des Serbischen

Stammes in Bosnien und der Hercegovina, sind ungleich einfacher und durchsichtiger als bei den Deutschen und Romanen. Die Hercegoviner und Bosnier befinden sich z. B. noch gegenwärtig zum grossen Teil in einem epischen Zeitalter, trotz oder vielleicht gerade wegen der vielen zu intensiven Berührungen mit deutschen, romanischen und türkisch-orientalischen, der slavischen unendlich überlegenen Culturen.

Mit überstürzender Eile verflüchtigt sich in aller neuester Zeit in Bosnien und der Hercegovina der ältere slavische Volksstamm. Für den Ethnographen gilt es noch zu retten und zu bewahren, was zu retten und bewahren ist. In diesem Behufe habe ich in den Jahren 1884 bis 1885 die genannten Provinzen bereist und durchforscht. Ueber die Ergebnisse meiner Forschungsreise habe ich mehrfach eingehend berichtet. Die Ausbeute an neuen Materialien fiel über alle Erwartung gross und umfangreich aus. Ich will nur eine Kategorie davon hier hervorheben, die epischen Dichtungen, deren ich über 160,000 Verse aus dem Volksmunde zum grössten Teil selber aufgezeichnet habe. Von besonderer Bedeutung sind die mohammedanisch-slavischen Epen, die sich sowohl durch poetische Ausdrucksweise und grosse Mannigfaltigkeit des Inhaltes als auch durch bedeutenden Umfang sehr vorteilhaft gegenüber den bisher bekannten Serbischen Hadjuken und verwandten Epen auszeichnen. Ich habe in meiner Sammlung z. B. ein Epos von 3157 Versen und über ein Dutzend solcher die mehr als 1600 Verse zählen. Neu und eigenartig ist ein jedes einzelne Guslarenlied darunter. Einige habe ich wohl schon im Texte mit ethnographischen Erörterungen und auch vereinzelt mit einer Uebersetzung versehen herausgegeben. Hier möge als Muster ein kleineres Lied dieser Art Platz finden. Das Lied commentirt sich von selber in seiner anspruchslosen Einfachheit. Die wenigen Fussbemerkungen sollen bloss zur Erinnerung, nicht etwa zur Belehrung dienen. Ich besitze auch ein Lied vom Ende des Helden Ibrâhim Nukić; dasselbe rührt aber von einem altgläubigen Guslar her. Es soll, womöglich einmal zur Vergleichung mit dem vorliegenden mohammedanischen, gleichfalls in dieser Zeitschrift Platz finden.

Bemerken will ich, dass die Handlung vor etwa 250 Jahren sich abgespielt haben mag und dass die im Liede genannten Persönlichkeiten auch anderweitig wohl beglaubigt erscheinen.

Zu Udbina an der Kaiserbrücke
in der weissgetünchten Kneipe sitzen
an des grünen Longja-Flüsschens Ufer
dreissig Edelleute von Udbina
und ergetzen sich an kühlem Weine.
Zwischen ihnen sitzt der greise Ćejvan
und an seiner Seite Fähnrich Nukić.

Zu V. 1. Udbina, gegenwärtig ein kleiner Bezirksort in der *Lika*, wird nun zu Kroatien gerechnet.

Zu V. 5. Die mohammedanischen Slaven verschmähten das Weintrinken nicht, im Gegensatz zu den übrigen, strenggläubigen Mohammedanern.

Da erscheint im weiten Feld ein Tatar;
und der Tatar ist schon gleich zur Stelle,
schwingt sich flink herab vom braven Rösslein
und tritt zu den Herren ein ins Wirtshaus.
— Selam alejć, Herren von Udbina!
rief er ihnen gellend zu auf Türkisch.
— Alejć selam! gaben in der Runde
einzeln ihm die Edlen gleich zur Antwort.
Und der Tatar greift in seinen Busen,
zieht heraus den kaiserlichen Ferman
und er reicht ihn dar dem greisen Ćejvan.
Ćejvan liest den Ferman, und ihm perlen
überm weissen Bart die Thränen nieder.
Fähnrich Nukić frägt ihn drob verwundert:
— O mein Ohm, du hochbetagter Ćejvan,
was verfliesst du so in Thränen schrecklich?
Sprich, woher ist dieser Brief gekommen?
Möcht ihn lodernd Feuer doch verzehren!
— O mein Schwestersöhnchen Fähnrich Nukić,
dieser Brief so zierlich kraus beschrieben
ist ein Ferman mit des Sultans Siegel.
"Einzufangen ist Vrek Gnjatijević
in dem grünen Hochgebirg Tihanja,
denn der Räuber lagert auf den Strassen
und mit dreissig seiner Raubgesellen
sperrt er ab den einen Weg zu Lande
und zwei andere die vom Meer ausführen.
Keine Kaufmannswaaren zieh'n des Weges—
keine Ballen, keine Maultierladung,
noch des Kaisers Steuergeld gewaltig.
Fang mir bald den Gnjatijević Vrek ein.
Sende mir sein Haupt hieher nach Stambol;
kannst du's nicht, so schick' den eig'nen Kopf her!"
Nun, mein Ibro, muss ich denn nicht jammern
weil ich jenen Kerl nicht kann erwischen?
— Liebster Ohm, mein Väterchen, mein Alter!
sei nicht traurig, lass den Mut nicht sinken,
denn dem Kaiser muss man stets gehorchen
Jetzo gilt es einen Plan zu fassen,
auf die Wüste Tihanja zu ziehen
und den Räuber im Gebirg zu suchen.

Zu V. 8. Tataren waren die offiziellen Courriere in der Türkei.
Zu V. 12. Türkisch richtig: selamaleikum=Friede mit Euch!
Zu V. 17. *Ferman*, Persisch: Brief.
Zu V. 30. Tihanja heisst im Volksmunde das nunmehr verkarstete Berggebiet im Südwesten von der Lika und dem chorvatischen Küstenland. Gemeint ist offenbar die alte Handelsstrasse, die von Zengg (Senj) nach Bosnien führte.

Nimm du mit an dreissig Kämpen tüchtig,
die ein Loch im Leibe wenig achten,
wenn die Kugel einem durch den Leib dringt,
und den jähen Tod, mein Ohm, verachten.
— O mein Ibro, du mein teu'rer Neffe,
du musst mit, sonst wär's kein rechter Kriegspfad.
O mein Väterchen, mein Ćejvanaga,
gerne zöge Ibro auf Tihanja
mit zum Fang des Räubers Gnjatijević;
doch ich hab 'ne Maid erst jüngst erworben,
des Bab Ahmetović von Otoka
holde Tochter, die viel edle Zilka.
Morgen kehrt mir heim mein brauner Renner,
auf ihm kommt schön Zilka hergeritten,
mit ihr hundert schmucke Hochgezeiter.
Vorwärts, Ohm, du sammle deine Mannen,
führ' die Mannen nach Karamanovci,
dorten wirst du deines Ibro harren
bis mein braunes Schlachtenrösslein heimkommt.
Dreissig Mannen schaarten um den Greis sich;
Fort zog Ćejvan nach Karamanovci.
Ibro blieb daheim auf schlanker Warte.
Doch schon nah'n die schmucken Hochgezeiter;
unter Zilka das braune Streitross.
Ibro sattelt wieder auf den Braunen,
und begibt sich auf die Ober-Warte,
legt da ab die schöne Festtagskleidung
und legt an die helle Waffenrüstung;
festigt um den Gurt den scharfen Säbel,
zwei Pistolen steckt er in den Gurt ein
und dann nimmt er in die Hand die Flinte,
seine blanke Damaszenerflinte.
Seine Mutter harrt im Hofraum seiner
und sie hängt sich um den Hals dem Sohne:
— "O mein Nukić, deines Mutter Freude!
nein, du darfst nicht in's Tihanj-Gebirge,
nach dem Räuber Gnjatijević jagen.

Zu V. 59 *Otoka*, gegenwärtig eir Dörfchen unweit des Städtchen *Krupa*, an dem Una-Flüsschen. Die Ruinen der Burgwarte Ahmetović's sind noch ziemlich gut erhalten. Bab Ahmetović war ein hochberühmter Held, wie ihn das Volkslied der Mohammedaner darstellt.

Zu V. 60. *Zilka* ist der slavisirte Name von Sulejma, bezw. Suleika.

Zu V. 62. Die Braut wird vom Hochzeitszug, nach türkischem Brauche, dem Bräutigam zugeführt. Der Zug wird von den Eltern des Bräutigams ausgerüstet.

Zu V. 66. Es ist eine Eigentümlichkeit der serbischen und zum Teil auch der anderen Volksausdrucksweise, dass der Erzähler häufig von sich als wie von einem dritten erzählt.

Ach, ich hatte neun, o weh' mir, Söhne,
Ćejvan hat mir alle neun entführet,
doch nicht einen je zurückgeführet.
Sohn ! noch jeder ist mir umgekommen,
Nun bist du mein einz'ger Trost ; Ibrâhim,
deine Mutter hat nur dich auf Erden !''
— ''Dennoch, Mutter, zieh' ich mit dem Oheim,
ja, ich schwör's bei dieser Welt und jener !''
Als sie sah, dass sie's ihm nicht verwehren
und Ibrâhim gar nicht kann bekehren
bat sie ihn von wehem Leid ergriffen :
''Geh mein Ibro auf die Wartekammer,
wo ich euch das Brautbett bergerichtet,
und erfreu dich deines Bräutchens Zilka.
Ach, vielleicht entspriesst dem Bund ein Sprössling,
dass mein Feuerherd nicht ganz veröde !''
Ibro geht nun auf die Oberwarte,
auf das Zimmer unterm Dach der Warte,
nimmt die Tambura aus Perlmutter,
klöpfelt hell darauf und singt ein Liedchen :
''Weilt mein Ohm schon auf Karamonovci ?
harrt er dort schon seines Fähnrichs Nukić?''
Bis zum hellen Morgengrauen spielte
er die ganze Nacht hindurch und wachte,
mocht' der Liebe Freuden nicht geniessen.
Gegen Morgen gab er seiner Zilka
in die Hand wohl dreimalhundert blanker, gelber
ungarländ'scher Golddukaten.
— ''Nimm da, Zilka, in Empfang die Mitgift
und dann noch nach Gebühr das Achtel,
komm ich jemals oder niemals wieder,
du bist ein für allemal gesichert.''
Ibro sprang nun auf und schritt zur Thüre,
lief hinab im Nu zu seinem Braunen,
schwang sich auf den zierlich schlanken Braunen,
ritt durch's Grün der Udbinaer Auen.
Als er in Karamanovci ankam
sah ihn schon von fern der greise Oheim ;
rasch erhob sich da der greise Ćejvan
küsste seinen Neffen auf die Stirne.
Und Ibrâhim hub nun an zum Greise:
— ''O mein Ohm, mein edler Ćejvanaga,

Zu V. 97. Die Brautkammer war in den Ritterburgen das oberste Gemach der Warte.

Zu V. 104. Tambura ist eine Art dünnbäuchiger, schmalhalsiger Mandolinen mit 4 bis 6 Stahlsaiten bespannt.

Zu V. 115. Er gibt ihr den achten Teil seines eigenen Besitzes, das der Mann im Falle einer Ehescheidung der Frau auszahlen muss.

Zu V. 126. Männer küssen einander auf die Stirne zwischen die Augenbraunen.

noch ist abgehetzt mein braunes Rösslein ;
lass uns diese Nacht allda noch nachten,
morgen fahnden wir dann nach dem Räuber.''
Und der Greis befolgt den Rat Ibrâhim's.
Als am Morgen früh der Morgen graute,
schaute Ibro nach den braven Rossen.
Alle hatten aufgezehrt den Hafer,
nur der Braune nicht einmal verkostet.
Voller Unruh' wiehert schrill das Rösslein,
reisst die Hürde um und scharrt den Boden.
Ibro sagt davon dem greisen Ćejvan.
Droh vergiesst der greise Ćejvan Thränen ;
— "Weh, ein böses Zeichen ! denn es kostet
mich mein Leben oder dich das deine,
oder wird dein braunes Streitross enden !"
Tranken drauf den Morgenbranntweinschoppen,
bis nach einer Weil' der greise Ćejvan
seiner Schaar von Waffenbrüdern zurief :
— "Wessen Mutter mag sich dess berühmen,
dass sie einen Heldensohn geboren,
wessen Schwesterlein sich dessen rühmen,
dass sie auf dem jungfräulichen Schoosse,
mir den tapf'ren Kämpen grossgezogen,
der mit meiner Schaar wär' ausgezogen,
um im grünen Hochgebirg Tihanja
jene Felsenlöhlung auszukunden,
ob sich Vrek noch im Gebirge aufhält
in der Kühle, unter Felsenwänden?"
Da verstummten alle die Gefährten,
senkten feig den Blick zu Boden nieder,
nur Ibrâhim Nukić kühn verwegen
schaute fest dem Greis in's braune Auge.
— "Greiser Ćejvan, hier ist solcher Kämpe,
der sich traut nach Tihanja zu gehen
Längs der zwölf verengten Felsenpässe ;
da kann Mann an Mann nicht vorwärts schreiten,
mag da keiner vor dem ander'n weichen
muss das scharfe Schwert den Pfad erweiten.
Horch nun auf, mein greiser Ćejvanaga,
sollt Ibrâhim schwer in Not geraten,
geb' ich Feuer meinen Paar Pistolen,
wirst du eiligst Hilf' in Not mir bringen."
"Ja, mein teu'res Kind, ach ja, mein Ibro !"
Küssten sich und nahmen letzten Abschied.
Ibro schwang sich auf sein braunes Rösslein,
zog entlang der sonnverbrannten Pässe
und durchzog sie alle heil und glücklich.

Als er in die Felsenhöhl' gelangte,
fand er speisenreich gedeckt die Tische
und mit Wein gefüllt die vollen Humpen.
Keiner von den Räubern war zugegen.
Darauf spornte Ibro an den Braunen,
jagte weiter ins Tihanja-Gebirge
bis er die Cisterne dort erspähte,
wo sich dreissig Räuber hingelagert,
Vrek Gnjatijević an ihrer Spitze ;
der gewahrte bald den Fähnrich Nukić ;
sprach darauf zu seinen dreissig Räubern :
— "Legt nicht auf Ibrâhim an die Flinten,
denn ich hab's gelobt beim Namen Gottes,
nie der Mutter einz'gen Sohn zu tödten.
Seiner Mutter einzig Kind ist Ibro
und zudem ein Held ganz sonder Gleichen.
Legt nicht auf Ibrâhim an die Flinten !"
Doch Ibrâhim rief er zu die Warnung :
— "He, für dich ist hier kein Wein bereitet !"
Ibro sprach darauf zu ihm vom Braunen :
— "Muss da meinen Braunen erst befragen,
ob für mich bei Euch kein Wein bereitet sei."
Alsbald zückte er den Säbel glänzend,
stürmte dreimal auf und ab im Kreise,
säbelte die dreissig Räuber nieder.
Vrek Gnjatijević zur Flucht sich wendend,
nahm aus seinem Gürtel zwei Pistolen,
beide silbern und dazu vergoldet,
und bedrohte jetzt den Helden Ibro,
um Ibrâhim Einhalt zu gebieten.
Zwei, ja dreimal rief ihm zu der Räuber :
— "Hetz mich länger nicht, Ibrâhim Nukić,
denn ich hab's gelobt beim Namen Gottes
nie der Mutter einzig Kind zu tödten !"
Ibro lässt sich dadurch nicht beirren,
sondern greift noch heft'ger an den Räuber.
Vrek reisst sich vom Leib drei goldne Buckeln
um Ibrâhim dadurch aufzuhalten,
Ibro mag die Buckeln gar nicht anschau'n,
stürmt noch böser los auf Vrek, den Räuber.
'S zückt Vrek sein grimmig scharfes Krummschwert

Zu V. 181. Im Karst findet man äusserst selten Quellwasser. Die Karstbewohner trinken ausschliesslich Regenwasser aus Cisternen.

Zu V. 186 ff. Derartige Gelübde gelobt jeder Räuber, so z. B. ist ein allgemeines Räubergelübde, keine Frauen noch Kinder zu tödten oder Mädchen zu vergewaltigen.

Zu V. 210. Buckeln, faustgrosse, geplättete Knöpfe auf dem Wams.

und rief aus voller Heldenkehle:
— "Jag mich nicht mehr weiter, Fähnrich Nukić,
denn ich tat bei Gott ein hoch Gelübde,
nie den Müttern ihre einz'gen Kinder,
ihrer alten Tage Trost zu tödten."
Ibro achtet dieser Reden gar nicht,
sondern jagt den Räuber Alpen abwärts.
Vrek ermüdete auf dieser Hetzjagd
und verbarg sich hinter einem Baumstrunk,
vor dem Aug erblitzte ihm die Flinte,
seine helle Damaszenerflinte;
und es traf den Falkensohn Ibrâhim
bös die Kugel mitten in die Leber.
Blut begann ihm aus der Brust zu quellen.
Ibro spornte schärfer an den Braunen
ohn' der heissen Wunde nur zu achten.
Dreimal schwang er seinen schweren Kolben,
liess auf Vrek ihn dreimal niedersausen,
nahm dann aus dem Busen rasch die Fesseln,
fesselte die Hände Vrek, dem Räuber.
Qualen schufen ihm die Todeswunden
die ihm Vrek's Gewehr und Hieb verursacht;
und er zog heraus das Paar Pistolen
gab zugleich den beiden lobend Feuer,
da befiel ihn finster schwer die Ohnmacht.
Als der Greis die zwei Pistolenschüsse
die ihm Kunde taten, jetzt vernommen,
sprang er augenblicklich auf die Beine,
schwang sich hurtig auf sein Ross, den Tauber,
und ihm folgten seine dreissig Mannen,
Gränzer sind es, auserles'ne Kämpen.
Als der Greis auf's Hochgebirg gelangte,
auf's Gebirge zum Cisternenwasser,
fand er dort die dreissig Räuberleichen.
Man besah der Reihe nach die Leichen,
doch darunter war nicht Fähnrich Nukić.
Alsdann folgt er rasch der Spur des Braunen
und er fand die kleinen zwei Pistolen,
fand darauf drei gold'ne Buckeln glänzend,
und erblickte bald in naher Ferne
unterm Braunen, unterm Falkenrösslein
Fähnrich Nukić matt und kraftlos liegen,
wie er sich im eignen Blute badet.
Neben Ibro sah er Vrek, den Räuber,
fest an einen Tannenbaum gebunden.

Zu V. 230. Kolben, d. h. den Streitkolben, der mit hervorste henden, scharfen Spitzen versehen war.

Bei Ibrâhim sinkt der Greis zur Erde
nieder und bedeckt ihn heiss mit Küssen.
"Kannst du, Ibro, diesen Schmerz verwinden?
glaubst du nicht, die Wunden werden heilen
wenn ich, Sohn, nach Udbina dich schaffe?"
— "Ach, die Wunden überleb' ich nimmer;
nimm mir lieber ab die Rüstung prächtig,
gürt mir die Gewaffen ab und Kleidung,
übergieb sie Halil, Mujo's Bruder.
Mögen sie von Held zum Helden wandern,
mag er lebenslang sich ihrer freuen
und des Bruders seiner Wahl gedenken!"
Darauf nahm der Greis ihm alle Kleidung
sammt der Rüstung uud den hellen Waffen,
zog dann heim in's Udbinaer Flachland
wohl mit Vrek Gnjatijević, dem Räuber,
führte heim den wohlgenährten Braunen.
Als ihn Nukić's Mütterchen erblickte
lief sie auf die Strasse ihm entgegen,
in den Händen hielt sie zwei Pistolen
und sie legte beide auf den Greis an.
Ein Gewehr versagte, nur das and're
gab sogleich ein Feuer, doch die Kugel
sauste durch die Luft am Greis vorüber.
Alsdann zog der Greis nach Sarajevo
in die Stadt zum Hasan-Paša Kahlkopf
um Vrek Gnjatijević auszuliefern.
Um des Räubers willen war der Paša
von Istambol nämlich hingekommen.
Vor den Paša bracht' der Greis den Räuber.
Darauf sprach zum Greis der edle Paša:
— "Nun, wie geht's dann meinem Wahlverwandten,
meinem teu'ren Bruder Fähnrich Nukić?"
— "Ausgezeichnet geht's dem Fähnrich Nukić,
hat sich doch der Bruder deiner Wahl erst
jüngst beweibt und jetzo kost und herzt er
tags und nachts sein trautes Eheliebchen."
Und der Paša schmunzelte vergnüglich

Zu V. 271. Halil der Falke, der Bruder Mustapha Henjica's (Hasenschwarte), des Herrn von der Burg *Kladuša*, unweit Udbina. Beide Helden, viel gefeiert und geehrt im Volke.

Zu V. 273. Ueber die Wahlbrüderschaft bei den Südslaven, vergl. "*Sitte und Brauch* der Südslaven," von *Krauss*, Wien, 1885, Cap. XXX.

Zu V. 287. Kahlkopf (Ćoso) ist der Spitzname. Es war der in der bosnischen Geschichte berühmte Hasan-Pasa-Tiro, der auch Gouverneur von Ofen war und die letzte Belagerung von Wien mitmachte.

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und dann frug er weiter aus den Alten :
— "Nun, wer hat den Strolch da eingefangen?"
— "Vrek? den hab' ich selber eingefangen."
Doch von rückwärts fällt ihm in die Rede
Vrek, der Räuber, ein : "O, was, du Stelze
willst den Räuber eingefangen haben?
Mich hat wohl ein Falke eingefangen
mutterseelenallein der Fähnrich Nukić."
Drob ergrimmte wild der edle Paša
und befahl den Greis mitsammt dem Händeng
Gnjatijević in dem allertiefsten
Kerker von Sarajevo einzusperren.
Auf der Alpe war der Falke Ibro
einsam sterbeletzt zurückgeblieben,
Horch! ein Jauchzen! Dreier Alpenvilen
hell Gejauchze schallt von Berg zu Berge.
Ein Alpenvila jauchzt am Abhang
unten tief der Alpe Romanija
und die zweite Vila jauchzt in Mitten
von der waldbedeckten Romanija,
doch die dritte jauchzt auf höchstem Gipfel
aller Bergeshöhen Romanija's.
Alsbald waren alle drei beisammen,
alle drei mit Nukić wohlverschwistert,
wandten hin und her den Fähnrich Nukić,
und sie riefen alle drei auf einmal :
"Diese Wunden lassen sich noch heilen!"
Volle sieben Wochentage pflegten
seiner nun die Vilen : auf die Wunden
legten sie so manches kräftig Kräutlein,
bis nach Ablauf voller sieben Tage
Nukić Ibro auf die Beine aufsprang
heil und munter ; und er griff nach einem
Tannenstab und zog fürbass des Weges
immer abwärts längs Karamanovei.
Auf das eb'ne Udbina gelangte
bald der Falke ; kaum erschauten ihn die
dreissig Gränzer, brachen aus die Mannen
in ein endlos Jubeln ob der Heimkunft.
Ibro rüstete dann aus ein Rösslein,
blieb zu Nacht zwei Nächte bei der Mutter,

Zu V. 304. Im Texte: *Šljaka*, "Stelze," "Krücke," d. h. Cejvan brauche Krücken, um vorwärts zu kommen.

Zu V. 314. *Vilen* sind *Waldfräulein*, ursprünglich als Baum- und später als Luftgeister gedacht. Die Vilen schliessen sich als Wahlschwestern besonders guten und wackeren Menschen an.

darauf machte er sich reisefertig
fort nach Sarajevo. Da bemerkte
Tale von Orašje : "O mein Wahlfreund,
ich begleit' dich ; denn mein greiser Alter
sitzt zu Sarajevo eingekerkert."
Ibro gab sich dess zufrieden, und sie
schwangen sich auf ihre feisten Pferde,
und es zogen fort die beiden Türken
wütig über Berge hin und Täler,
glücklich kamen sie an in Sarajevo.
Im Serail sitzt Hassan-Paša-Tiro.
Kaum erschaut der Paša seinen Wahlfreund,
so befiehlt er, dass aus Kriegskanonen
Pöllerschüsse seine Freude künden.
Es begrüssten sich die Wahlgebrüder,
legten in einander ihre weissen
Hände und begaben Hand in Hand sich
in die weichen Stuben, die mit Pölstern
und mit Teppichen so reich bedeckt sind.
Und sogleich erkundigte sich Ibro,
wo sein greiser Ohm bis nun geblieben.
— "Dort, im dunkeltiefen Burgverliesse
schmachtet er zusammen mit dem Räuber
Vrek Gnjatijević ; es soll dein Alter
augenblicklich freigelassen werden.
Doch nun sprich, mein teuerster Ibrâhim,
was für Lohn begehrst du jetzt vom Kaiser?"
— "Bruder meiner Wahl, ich wünsch' mir einzig
nur ein Schwert mit kaiserlichem Sigel
wonach ich befugt wär' und berechtigt,
allezeit nach eigenem Ermessen
unbehelligt von dem Landeshauptmann,
in das Grenzgebiet auf Raub zu ziehen."
Ohne weiters gab ihm's Schwert der Paša,
ohne drauf noch ein Wort zu sagen.
Alsdann sprach er zum Orašjer Tale :
— "Sag nun du, bei Gott mein Bundesbruder,
sag', womit ich dich nun könnt' erfreuen?"
— "Ich verzicht auf's Kampfschwert unterm Sigel

Zu V. 343. Tale (türk. *Narr*) war der Schalksnarr unter den Helden, ein grimmer Degen, mit dem nicht zu spassen war.

Zu V. 351. Serail, vom Pers. *seraj*, königlicher Hof. Slavisirt *saraj*. Davon der Name der Stadt Sarajevo oder Serajevo (zum Serail gehörig).

Zu V. 369 ff. Sablja pod muhurom. Solche Ehrensäbel mit dem obgedachten Rechte, wurden nur den ausgezeichnetsten Grenzhauptleuten verliehen. Auch Muslapha Henjica besass einen. Nach dem Ableben des Helden, musste der Säbel zurückgegeben werden.

insolang ich meinen dicken Kolben
mit den Buckeln habe ; kann, o Bruder,
auch mit ihm auf Kriegespfaden wandeln,
schenk mir lieber Geld auf Reisegehung.
Da beschenkte ihn der Paša reichlich
wohl mit einer halben Maultierladung
lauter weisser Talerstücke, die in
einem Steinkrug aufbewahrt gewesen.
Tale von Orašje lachte hell auf.
Alsdann schwangen sie sich auf die Rosse,
stiegen auf die Rosse auf im Hofe,
und sie ritten fort, der Greis als Erster
und als Zweiter folgte nach Ibrâhim,
und als letzter Tale auf dem Fahlen.
Als sie in der Handelsstrasse waren
bei den Handelsleuten in Sarajevo
streute Tale aus die weissen Taler
um sich ringsherum auf beide Seiten.
Hei, wie sich darum im Gassenkote
laut im Streit die flinken Jungen balgten!
Wie nun Tale in der Kneipe abstieg,
da besass er nicht einmal ein Kleingeld
um sich einen kühlen Trunk zu zahlen,
sondern musst' nach altem Brauche pumpen.
Darauf zogen unsere Helden heimwärts.
Was für Taten einst sich zugetragen
dess gedenke man in unser'n Tagen
wie des Georgstags vor allen Tagen
wie des Helden kühn vor allen Magen.

Action of the Gas from As_2O_3 and HNO_3 upon m-Oxybenzoic Acid.

By Edgar F. Smith (Springfield, Ohio).

(*Read before the American Philosophical Society, September 7, 1888.*)

In Volume viii, No. 2, of the *American Chemical Journal,* it was shown that when the vapor arising from arsenic trioxide and nitric acid was permitted to act upon the ethereal solution of methyl salicylate that both the α- and the β-nitrosalicylic acids resulted.

Since then I prepared the ethyl ester of m-oxybenzoic acid and subjected it to a similar action. A powder of a brick-red color separated from the cooled ethereal solution. The ethereal filtrate from the powder was carefully evaporated upon a water-bath when there remained an oil of a dark-red color.

The red powder was boiled for some time with a potassium hydroxide solution, the latter concentrated and acidified with hydrochloric acid, when a yellow mass was precipitated. This was dissolved in hot water, from which it crystallized, on cooling, in yellow leaflets. These melted constantly at 230° C. By reference to *Berichte*, 20, 404, it will be seen that four distinct, nitro-m-oxybenzoic acids exist; of these the β-acid melts at 230° C., and crystallizes in yellow leaflets. Other points of similarity show that the acid obtained by me is identical with that termed β nitro m-oxybenzoic acid.

The red oil exhibited no signs of crystallization, although I allowed it to stand undisturbed for several months. It was also boiled with concentrated potassium hydroxide for ten hours. After concentration it was allowed to cool, when rather large and well-defined monoclinic prisms, having a deep chrome-red color, appeared. The salt was purified by recrystallization from water, and analyzed. Two estimations of the potassium gave 13.02% and 13.00% K. On heating the salt explodes with violence. The free acid crystallizes from water in long needles having a light yellow color. It melts at 111° C. Like its salt it explodes when heated. Its taste is intensely bitter. In all respects it resembles the trinitro-m-oxybenzoic acid mentioned by Griess, *Annalen*, 117, 28, and Beilstein, *Annalen*, 139, 11. These chemists, however, make no mention of the melting point. The percentage of potassium required by an anhydrous salt of this acid is 12.58%.

The difficulty experienced in obtaining large quantities of the acid is due to the fact that there are other products formed in the nitration process, and these cling tenaciously to the acid, defying the most persistent efforts to effect their removal.

Stated Meeting, May 18, 1888.

Present, 15 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

Letters of envoy from Institut Egyptien, Cairo; Institut Météorologique de Roumanie, Bucharest; Museum of Comparative Zoölogy, Cambridge, Mass.

Letters of acknowledgment from Institut Egyptien, Cairo (125); Magyar Tudományos Akademia, Buda-Pesth (125); Prof. Edward Suess, Vienna (125, 126); Verein für Geogra-

phie und Statistik, Frankfurt-am-Main (126); Prof. Paul Albrecht, Hamburg (126); Société Entomologique, Bruxelles (126); Prof. W. B. Dawkins, Manchester, Eng. (126); Mr. Joseph Prestwich, Shoreham, Kent, Eng. (125, 126).

Accessions to the Library were reported from Institut Egyptien, Cairo; Institut Météorologique de Roumanie, Bucharest; K. P. Akademie der Wissenschaften, Berlin; K. Gesellschaft der Wissenschaften, Göttingen; K. Sächsische Gesellschaft der Wissenschaften, Leipzig; R. Accademia dei Lincei, Biblioteca N. C. V. E., Rome; R. Geological Society of Cornwall, Penzance; Mr. R. A. Macfea, Edinburgh; Messrs. J. R. Leeson & Co., Boston; New York Academy of Sciences, Dr. J. S. Newberry, Publishers of "The Globe," New York; Mr. W. J. Potts, Camden; College of Pharmacy, Zoölogical Society, Dr. J. Cheston Morris, Philadelphia; Pennsylvania Geological Survey, Harrisburg; Departments of State and of the Interior, Washington, D. C.; Mr. M. C. Read, Hudson, O.; Museo Michoacano, Morelia, Mexico.

The death of Dr. Gerhard vom Rath was announced as having occurred on April 23, 1888.

Pending nominations Nos. 1176 to 1179 were read and spoken to and balloted for.

Pending nomination No. 1180 was postponed.

The Proceedings of Officers and Council were submitted.

The following persons were reported as having been duly elected members of the Society:

Mr. Talcott Williams, Philadelphia,

Prof. J. McKeen Cattell, Philadelphia,

Prof. Alphonse Favre, Geneva.

And the Society was adjourned by the President.

Stated Meeting, September 7, 1888.

Present, 2 members.

Vice-President, Dr. RUSCHENBERGER, in the Chair.

Correspondence was submitted as follows:

Letters desiring exchanges from the Observatorio Meteorológico-Magnético Central-Mexico, and the Deutsche Wissenschaftliche Verein, Santiago; New Haven Colony Historical Society. On motion, the requests were granted.

Circular from the R. Society of N. S. W. offering premiums and medals for 1888, 1889, 1890.

Circular from the Société d'Anthropologie de Paris in relation to the proposed exposition in 1889.

Circular from the International Congress of Americanists in regard to the meeting to be held at Berlin in October, 1888.

Circular from the University of Bologna, thanking the Society for sending a delegate to its 800th anniversary.

The following deaths were announced:

Sir George Burrows, London.

Rev. James Freeman Clarke, Jamaica Plains, Mass., June 8, 1888, æt. 78.

Rev. Charles W. King, Cambridge, England, March 25, 1888 (born Sept. 18, 1818).

Mr. Philip H. Law, Philadelphia, May 22, 1888, æt. 49.

Prof. Henry Carvill Lewis, Philadelphia, July 20, 1888, æt. 36.

On motion, the President was authorized to appoint at his discretion suitable persons to prepare the usual obituary notices for Messrs. Law and Lewis.

Prof. Coleman Sellers presented his photograph for the Society's Album.

Letters of envoy were received from the Mining Department, Melbourne, Victoria; Linnean Society of New South Wales,

Sydney; Geological Survey of India, Calcutta; Naturforschender Verein in Brünn; Physikalisch-medicinische Societät, Erlangen; Verein für vaterländische Naturkunde, Württemberg; Société de Physique et d'Histoire Naturelle, Genève; Bibliothéque de l'Université R. de Norvige; Royal Statistical Society, Christiania; Meteorological Office, London; Literary and Philosophical Society, Manchester; Royal Irish Academy, Dublin; Bureau des Longitudes, Musée Guimet, Profs. Jules de Guerne, E. Levasseur, Paris; Gen. H. L. Abbot, New York; Gen. C. W. Darling, Utica; Elliott Society of Science and Art, Charleston; Indiana Society Civil Engineers and Surveyors, Remington; Sociedad Mexicana de Geografia y Estadistica, México; Museo Nacional de Buenos Aires; Museu Nacional do Rio de Janeiro.

Acknowledgments were received from the Royal Society of Victoria (126); Royal Society of New South Wales (126); Linnean Society of New South Wales, Sydney (96–126); Geological Survey of India, Calcutta (126); Prof. Peter von Tunner, Leobon, Austria (126); K. K. Geolog. Reichsanstalt, Drs. Matthaeus Much, Dionys Stuer, Wien (126); Prof. Otto Donner, Helsingfors, Finland (126); Comité Geologique de la Russe, Imp. Russian Geographical Society (126); Profs. Serge Nikitin, J. Pomialowsky, St. Petersburg (126); Observatoire Astronomique et Physique de Tashkend, Russia (126); Deutsche Geologische Gesellschaft, Gesellschaft für Erdkunde, K. Preuss. Meteorologisches Institut, Berlin (126); University of Bonn (126); Verein für Erdkunde, Dresden (126); Naturwissenschaftlicher Verein des Regierungs-Bezirks, Frankfurt a. O. (96–127); Oberhess. Ges. für Natur und Heilkunde, Giessen (126); Geographische Gesellschaft, Hannover (125); Bibliothek des Vogtl. Alterthumsforschender Vereins, Hohenleuben (96–126, etc.); Zoologischer Anzeiger, Leipzig (126); Verein für vaterländische Naturkunde in Württemberg, Stuttgart (125, 126); Prof. C. L. Rütimeyer, Basle, Switzerland (126); Société de Physique et d'Histoire Naturelle, Genève (Trans. XVI, 1, and Proc. 124, 125); Bibliotheque de l'Université R. de Norvége, Christiania (117–124, etc.); Prof. Japetus Steen-

strup, Copenhagen (126); Société R. de Zoologie, Amsterdam (126); K. Zoologisch Genootschap, The Hague (126); Fondation de P. Teyler van der Hulst, Harlem (126); Maatschappij Nederl. Letterkunde, Biblioteca N. C., Firenze (126); Dr. C. Leemanns, Leiden (126); R. Instituto Lombardo, Milan (126); Acad. R. des Sciences, Lettres et Arts, Modena (117–122, etc.); Prof. G. Meneghini, Pisa (126); R. Accademia dei Lincei, Roma (126); R. Osservatorio Astronomico, Torino (126); Station Séricole, Montpellier (126); Société de l'Histoire de France, Paris (126); Prof. Léon de Rosny, Paris (125); Société Polymathique, Vannes (126); Bath & West of England Society, Bath (126); Prof. J. P. Postgate, Cambridge (126); Rev. George Rawlinson, Canterbury (126); Messrs. Trübner & Co., London (119); Royal Society of Edinburgh (120–127); Oneida Historical Society, Utica, N. Y. (125, 126, etc.); Academy of Natural Sciences, Mercantile Library, Mr. Richard Wood, Philadelphia (126); Newberry Library, Chicago (96–126, etc.); Observatorio Meteorologico Magnetico Central (102, 103, 104, 106, 107, 108, 116, 125, 126), Observatorio Astronomico Nacional Mexicano, Tacubaya (126); South African Philosophical Society, Cape Town (124, 125); Bishop Crescencio Carrillo, Merida, Yucatan (126).

Accessions to the Library were announced from the Royal Society of Victoria, Department of Mines and Water Supply, Melbourne; K. K. Sternwarte, Prag; Naturwissenschaftlicher Verein, Frankfurt a. O.; Archives Néerlandais, Haarlem; K. Zoologisch-Botanische Genootschap, 'S Gravenhage; Biblioteca N. C. V. E., Rome; Linnean, R. Statistical, R. Astronomical, R. Geographical Societies, London; R. Irish Academy, Dublin; New Hampshire Historical Society, Concord; American Academy of Arts and Sciences, Boston; Museum of Comparative Zoölogy, Harvard College Observatory, Cambridge; New Jersey Historical Society, Newark; Prof. F. A. Genth, Philadelphia; Signal Office and Surgeon-General's Office (War Department), U. S. Department of Agriculture, Dr. Albert S. Gatschet, Washington, D. C.; Colorado Scientific Society, Denver; Dr. L. Darapsky, Santiago de Chili.

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The following papers were presented through the Secretaries:

"*Ibrâhim Nukić*, ein Guslarenlied der Hercegovina," by Dr. Frederick S. Krauss (Vienna).

"Action of the Gas from As_2O_3 and HNO_3 upon *m-Oxybenzoic Acid*," by Prof. Edgar F. Smith (Wittenberg College, Springfield, Ohio).

"The Cretaceous and Tertiary Geology of the *Sergipe Alagôas* Basin of Brazil," by Prof. John C. Branner (Little Rock, Arkansas).

On motion the paper of Dr. Branner was referred to a Committee of three to examine and report if desirable for the Transactions.

The Chairman appointed Messrs. Heilprin, Leidy and Rand as such committee.

Mr. Phillips, delegate for the Society to the celebration of the 800th anniversary of the foundation of University of Bologna, presented an oral report.

Pending nomination 1180 was read.

And the Society was adjourned by the presiding member.

Stated Meeting, September 21, 1888.

Present, 3 members.

President, Mr. FRALEY, in the Chair.

The Indiana Society of Civil Engineers and Surveyors, Remington, Indiana, requested to be placed on the exchange list; on motion it was ordered that it should be so placed.

Letters of acknowledgment for 127 were read as follows:

Prof. Franz Ritter v. Hauer, Vienna; Gesellschaft für Erdkunde, Berlin; Dr. Paul Albrecht, Hamburg; Naturhistorische Gesellschaft, Hannover; Verein für Thüringische Geschichte und Alterthumskunde, Jena; Dr. C. A. Dohrn, Stettin; Prof. Remi Siméon, Société de Geographie, Paris; Prof.

Lucien Adam, Rennes; Royal Society, Royal Institution, Royal Astronomical, Meteorological, Statistical Societies, Linnean Society, Society of Antiquaries, Victoria Institute, Science and Art Department, Mr. William Blades, Prof. William Crookes, London; Cambridge Philosophical Society, University Library, Mr. J. C. Adams, Prof. J. P. Postgate, Cambridge; Manchester Literary and Philosophical Society; Sir Henry Ackland, M.D., Oxford; Sir William Thomson, Glasgow; Mr. Everard F. im Thurn, British Guiana; Geological and Natural History Survey, Dr. A. R. C. Selwyn, Ottawa; University of Toronto; Historical and Scientific Society, Winnipeg; Portland Society of Natural History, Maine Historical Society, Portland; New Hampshire Historical Society, Concord; Northern Academy of Arts and Sciences, Prof. Charles H. Hitchcock, Hanover, N. H.; Mass. Historical Society, State Library of Massachusetts, American Academy of Arts and Sciences, Boston Society of Natural History, Mr. Stephen P. Sharpless, Hon. Robert C. Winthrop, Boston; Harvard College Library, Museum of Comparative Zoölogy, Profs. Alexander Agassiz, Joseph Lovering, J. D. Whitney, Mr. Robert N. Toppan, Cambridge; Free Public Library, New Bedford; Dr. Pliny Earle, Northampton; Essex Institut, Salem; American Antiquarian Society, Worcester; Brown University, Providence; Franklin Society, Rhode Island Historical Society, Prof. Thomas Chase, Providence, R. I.; Prof. W. LeConte Stevens, Brooklyn; Society of Natural Sciences, Buffalo; Prof. Edward North, Clinton; Prof. B. G. Wilder, Ithaca; Astor Library, N. Y. Academy of Medicine, N. Y. Historical Society, N. Y. Hospital Library, University of the City of New York, General H. L. Abbot, Dr. Joel A. Allen, Capt. Richard Somers Hayes, Dr. J. S. Newberry, Mr. R. W. Raymond.

Accessions to the Library were announced from Prof. Serge Nikitin, St. Petersburg; Physiologische Gesellschaft, Berlin; Société Zoologique de France, Marquis de Nadaillac, Paris; Royal Society, Editors of "Nature," London; Penzance Natural History and Antiquarian Society, Plymouth; Geological and Natural History Survey of Canada, Montreal; Boston

Society of Natural History; American Academy of Arts and Sciences, Cambridge; Essex Institute, Salem; Connecticut Academy of Arts and Sciences, New Haven; Dr. J. S. Newberry, New York; College of Pharmacy, Prof. E. D. Cope, Mr. Henry Phillips, Jr., Philadelphia; Prof. Ira Remsen, Baltimore; Smithsonian Institution, Washington, D. C.; University of California, Berkeley, Cal.; Dr. J. J. Stevenson, New York City; Vassar Brothers' Institute, Poughkeepsie; Oneida Historical Society, Utica; Prof. Henry M. Baird, Yonkers; U. S. Military Academy, West Point; Rev. J. F. Garrison, Camden; New Jersey Historical Society, Newark; Prof. Geo. H. Cook, New Brunswick; Prof. C. A. Young, Princeton; Dr. Robert H. Alison, Ardmore; Rev. Joseph A. Murray, Carlisle; Dr. Traill Green, Prof. Thomas C. Porter, Easton; Mr. Andrew S. McCreath, Harrisburg; Haverford College, Profs. Lyman B. Hall, Allen C. Thomas, Haverford College; Mr. John Fulton, Johnstown; Linnean Society, Lancaster; Mr. Peter Rothermel, Linfield; Mr. John F. Carll, Pleasantville; Mr. V. W. Sheafer, Pottsville; Lackawanna Institute of History and Science, Scranton; Mr. M. Fisher Longstreth, Sharon Hill; Philosophical Society, Mr. Philip P. Sharples, Hon. Washington Townsend, West Chester; Wyoming Historical and Geological Society, Wilkes-Barre; Academy of Natural Sciences, Numismatic and Antiquarian Society, College of Physicians, Engineers' Club, Franklin Institute, Historical Society of Pennsylvania, Profs. John Ashhurst, Jr., F. A. Genth, F. A. Genth, Jr., H. V. Hilprecht, M. H. Haupt, H. Carvill Lewis, John M. Maisch, Geo. Inman Riché, James Tyson, W. P. Wilson, Revs. F. A. Mühlenberg, H. Clay Trumbull, Drs. J. H. Brinton, Persifor Frazer, W. W. Keen, Morris Longstreth, Isaac Norris, Charles A. Oliver, Ruschenberger, William H. Wahl, Messrs. R. L. Ashhurst, Cadwalader Biddle, Charles Bullock, Isaac Burk, Thomas M. Cleemann, Patterson DuBois, Jacob B. Eckfeldt, Philip C. Garrett, Frederick Graff, J. S. Harris, W. W. Jefferis, Benj. Smith Lyman, C. Stuart Patterson, Henry Pemberton, Samuel W. Pennypacker, Theo. D. Rand, G. B. Roberts, L. A. Scott, Coleman

Sellers, Aubrey H. Smith, W. P. Tatham, Richard Wood, Com. E. Y. McCauley, Philadelphia; Mr. William M. Canby, Wilmington, Del.; U. S. Naval Institute, Annapolis; Johns Hopkins University, Maryland Institute for the Promotion of the Mechanic Arts, Baltimore; Smithsonian Institution, Library of the Surgeon-General's Office, U. S. Geological Survey, Signal Office, War Department, Col. William Ludlow, Gen. Montgomery C. Meigs, Col. Garrick Mallery, Prof. J. H. C. Coffin, Messrs. Albert S. Gatschet, Charles V. Riley, Charles A. Schott, William B. Taylor, Washington, D.C.; Leander McCormick Observatory, Prof. J. N. Mallet, University of Virginia; Elisha Mitchell Scientific Society, Chapel Hill, N. C.; Elliott Society of Science and Art, Charleston; University of South Carolina, Columbia; Georgia Historical Society, Savannah; University of Alabama, Tuscaloosa; Prof. E. W. Claypole, Akron, O.; Cincinnati Observatory, Prof. James M. Hart, Cincinnati; Dennison University, Granville, O.; Rev. Henry S. Osborn, Oxford, O.; Prof. Edgar F. Smith, Springfield; Dr. Robert Peter, Lexington, Ky.; Tennessee Philosophical Society, Columbia; Profs. Henry S. Frieze, Alexander Winchell, Ann Arbor, Mich.; Prof. Daniel Kirkwood, Bloomington, Ind.; University of Illinois, Champaign; Chicago Academy of Science, Chicago Historical Society, Newberry Library, Chicago; Rantoul Literary Society, Rantoul, Ill.; Prof. John C. Branner, Little Rock, Ark.; Davenport (Iowa) Academy of Natural Sciences; State Historical Society of Wisconsin, Madison; State Historical Society, Washburn College, Topeka, Kans.; Colorado Scientific Society, Denver; University of California, Profs. John and Joseph LeConte, Berkeley, California.

The deaths of the following members were announced:

Prof. Richard A. Proctor (born, September 3, 1837; died, September 12, 1888).

Mr. John Price Wetherill (born, April 4, 1828; died, September 17, 1888).

On motion, the President was authorized to appoint a suitable person to prepare the usual obituary notice of Mr. Wetherill.

The President reported that, pursuant to the request of the Society, he had appointed Dr. D. G. Brinton to prepare an obituary notice of the late Philip H. Law, and Prof. Lesley that of the late H. Carvill Lewis.

A paper by Dr. H. A. Hare was presented for the Transactions entitled, "The Pathology, Clinical History and Diagnosis of Diseases of the Mediastinum other than those of the Heart and Aorta;" which, on motion, was referred to Drs. Ruschenberger, Allen, and Sharp, as a committee to examine and report thereon.

Pending nomination 1180 was read.

The President reported that he had received and paid over to the Treasurer $133.07 interest due July 1, 1888, from the Michaux legacy.

And the Society was adjourned by the President.

James Curtis Booth, Ph.D., LL.D. By Patterson DuBois, Philadelphia.

(Read before the American Philosophical Society, October 5, 1888.)

The life of the individual, like the history of a people, is generally divisible into a more or less well-markt series of epochs or periods. The life of Dr. Booth falls naturally into three such divisions, each quite distinct in kind, yet all animated by the same principles of intellectual acquirement, the same moral of motive, the same love of learning, the same ardor in teaching, the same activity in business, the same hearty devotion to the bettering and uplifting of his feilow-men.

The first period in the career of James Curtis Booth was his preparatory or student life. For convenience' sake, we must include here the record of his parentage and birth. He was born in Philadelphia, July 28, 1810. His father was George Booth, of New Castle, Delaware; his mother was Ann Bolton, daughter of John and Eleanor Bolton, of Chestertown, Maryland.

After his preliminary schooling in Philadelphia and at the seminary of Hartsville, Bucks County, Pa., he entered the University of Pennsylvania, where he was graduated in 1829. He subsequently spent a year at the Rensselaer Polytechnic Institute, Troy, N. Y. But the great bent of his mind was for chemistry; and chemistry to him was a thing beyond mere theory; it had for him a meaning quite apart from the beauties of blackboard demonstrations and of symbolized reactions. His great thought was to find in the laboratory a miniature factory; in the factory a mam-

moth laboratory. To this thoroughly utilitarian end he lookt. How fervently he cherisht this thought, how determined he was to accomplish his purpose, may be in some degree inferred from his pushing beyond the sea at a time when fashion had not yet conceived the real or nominal virtues of an education abroad. He was, indeed, the first American student in analytical chemistry who had so ventured into Germany. There being no such thing on either side of the Atlantic as a students' laboratory, he spent the year 1833 in Prof. Friedrich Wöhler's private laboratory in Hesse-Cassel. He next practiced for nine months in the laboratory of Prof. Gustav Magnus, at Berlin. The remainder of his three-year term abroad was spent in attending lectures in Berlin and in Vienna, and also in visiting various manufacturing establishments on the Continent and in England. With his return to his native city in the latter part of 1835, or early in 1836, we may consider his student or formative period (while he was in his twenty-sixth year) to have come to a close.

Obstacles to progress often become, in the end, the surest means of advancement. It was no doubt largely owing to the difficulties which Mr. Booth had to surmount that he conceived the educational scheme which was the parent of all our existing laboratories for students in applied chemistry. With the establishment of his students' laboratory in 1836 (which two years ago celebrated its semi-centennial), we may consider the second, or teaching period of our subject's career, to be fairly inaugurated. This, though the shortest of the three, was preëminently the creative period of his life.

I call it creative, because it called into being a method of technical education which has, probably more than anything else, resulted in establishing chemistry as a factor in commerce, and in gaining for the chemist a recognized position in the economy of the world's work. In fact, the students' laboratory, as instituted by Mr. Booth, bore a relation to mere class-room teaching analogous to that which the "natural method" in languages bears to the more bookish method of study by the set rules of grammar and rhetoric.

But it was no part of Mr. Booth's idea to make the laboratory course usurp the rightful position of the text-book and the lecture. He saw the great want of a supplementer rather than a supplanter. How truly he discerned what the scientific as well as the commercial world required, and how fully he met that requirement, needs no expansion here. The students' laboratories all over the country—if not beyond—as well as the throng of students who have come into and gone from his own laboratory during the past half-century—all attest the foresight, the judgment, the independence, the energy, of a scientist and a business man.

But the chemical workshop was not enough. He received an appointment from the Franklin Institute as Professor of Chemistry Applied to the Arts, in 1836; and during the nine successive winters (1836–1845) he delivered three courses of lectures, each course occupying three seasons. During this period, also, he filled the chair of chemistry (1842–1845) in

the Central High School of Philadelphia. Nor was he wholly content with his sphere as a teacher. His studies had reacht out across and beyond the confines of his specialty into the neighboring territories of mineralogy and geology.

Concerning this field of our subject's labors, no one is so well qualified to speak as Prof. J. P. Lesley; and I am indebted to him for the following paragraphs regarding the geological surveys of Pennsylvania and Delaware. He says: "Prof. Booth and John Frazer, then a young man, were appointed by Prof. Rogers, in the spring of 1836, his two assistants in prosecuting the work of the First Geological Survey of Pennsylvania. From Spring to Fall they traveled along the Susquehanna and Juniata valleys, blocking out the order of the great formations. Prof. Booth was sent by Prof. Rogers up the Potomac to make a section which could be compared with the Juniata section; and when the three met at Huntingdon, he announced, to the astonishment of Mr. Rogers, that the mountains which fill the middle belt of Pennsylvania were made by two separate formations, now known as No. IV and No. X. Mr. Rogers was unwilling to accept this conclusion, and instructed Mr. Frazer to go to the Huntingdon-Bedford line and make a cross-section from the Broad Top coal down to the limestone of Morrison's Cove. At the end of the week the three met again in Huntingdon, and Mr. Frazer confirmed the statement of Prof. Booth. Mr. Rogers was still dissatisfied, and then went himself to repeat the section made by Mr. Frazer, finding it correct, and then accepting Prof. Booth's Potomac section. Thus the grand column of our palæozoic formations was establisht, and the credit of it is due to Prof. Booth."

Prof. Lesley adds that: "Both Prof. Rogers' assistants resigned at the end of the year; and Mr. Booth was then appointed, immediately, or not long thereafter, State Geologist of Delaware. His work in Delaware was publisht in his Report, an octavo volume, now so rare that it is impossible to obtain a copy. My belief is that Prof. Booth abandoned field work very early in his career, and devoted himself to his chemical laboratory. At all events, he is known in science altogether as an accomplisht chemist, with a great reputation for diligence and accuracy, especially in the field of mineral analysis." To Prof. Lesley's statement I may add that the Geological Survey of the State of Delaware was in Mr. Booth's charge during 1837–8; the reports were publisht as the Annual Reports of the Delaware Geological Survey (Dover, 1839), and after that he issued the "Memoir of the Geological Survey of the State of Delaware with Application to Agriculture" (Dover, 1841).

Mr. Joseph E. Hover, an old friend and co-worker with Prof. Booth, thus writes of another venture:

"In the year 1845, Prof. Booth visited Mine la Mott, a mining locality in the State of Missouri, and began the mining of cobalt, which, I think, had but recently been discovered there. After a time he had mined a large amount of cobalt, which he forwarded to England. But this enter-

prise proved unsuccessful, as the article was not found to be pure. The result was its reshipment to this city. In the old chemical works of the late Dr. Uhler, situated in the upper part of this city, the Professor began with his usual energy to prosecute the work of acquiring a knowledge of the best method of refining cobalt. This question of the refining of this metal was one that was obscure to all outside of the then existing cobalt refineries in the world, so the task the Professor had undertaken was one fraught with perplexing difficulty. But the effort was successful."

Mr. Booth's achievements early in his career gained him a membership in this Society, January 18, 1839. Though of recent years he seldom visited these rooms—his residence being at Haverford College—yet he always had a warm spot in his heart for the associations of our venerable hall, and a true regard for the honor of a seat upon this floor.

He contributed to the Transactions, N. S., VIII, p. 185, in connection with Prof. Martin H. Boyé, a paper on the Conversion of Benzoic Acid into Hippuric Acid.

These ventures into the field of scientific literature were enlarged by Reports from the Franklin Institute Committee on Science and the Arts, which were of Prof. Booth's writing; by a report on "Recent Improvements in the Chemical Arts," published by the Smithsonian Institute in 1852; and by his most conspicuous effort in literature, well known as the "Encyclopædia of Chemistry" (Phila., 1850). This was written chiefly by himself. Dr. Campbell Morfit rendered much assistance, however, on the last half of the work; and Prof. R. S. McCulloh contributed articles on Electricity and the Hydrometer, while Dr. Boyé contributed articles on Alcohol Analysis, and some other subjects.

This brings us to the close of the second period. As an instructor, Mr. Booth seems to have had unusual success. Dr. Alexander Mucklé, for some years past an assistant to the Melter and Refiner of the Mint, an early pupil of Mr. Booth, and subsequently himself a student under Wöhler and under Bunsen, says: "With this experience of teachers and means of comparison, I can say that Mr. Booth had few if any superiors as a teacher of practical chemistry, that he kept abreast of the times by constantly securing the best and latest scientific books and periodicals." But testimony of this sort is barely necessary. A course in his laboratory, says the *Scientific American*, "was considered necessary for the chemist of that time, and was regarded of more value than a college diploma." * * * "This institution soon acquired considerable distinction, * * * and during the course of a few years nearly fifty students availed themselves of his instruction, most of whom have since acquired distinction." It would be interesting, if it were possible, to calculate the influence that through them he has wielded and still wields upon the vast manufacturing and economic interests of a busy world.

The third period begins and ends with Prof. Booth's official life. Through his friend, Secretary Meredith, the office of Melter and Refiner of the Mint was placed at his disposal, and the appointment was made by

President Taylor. Prof. Booth assumed the duties of office, December 10, 1849. "The date," says Mr. Robert Patterson, "was nearly coincident with the discovery of gold in California, and the pressure of deposits from that source had already become heavy.

"The gold reacht the Mint for the most part in its native state, and required intricate and at the same time accurate and prompt metallurgic treatment to fit it for coinage. In one particular the Mint was ill prepared to sustain the pressure brought to bear upon it. The California gold being naturally alloyed with silver in excess of the amount admissible in the coinage, it was necessary to extract the superfluous metal by chemical treatment. The appliances at the Mint, which had proved sufficient to treat bullion received anterior to the California discoveries, were quite inadequate thereafter. It was necessary to reconstruct the whole plan of the parting apparatus, and this work devolved upon Mr. Booth. Under his supervision a process which had before been little more than one of the laboratory expanded into that of a manufactory. To this work, as well as to all the other labors of his department, he brought the full knowledge of theory and practice derived from former professional experience, and further showed, what is not always the case with chemists, a capacity to apply his knowledge in the larger way required for commercial results. Some little impatience at the delay in introducing the needful changes had been exhibited by bullion dealers and others, ignorant of the obstacles attendant thereon; but all difficulties were overcome, and the parting (or refining) capacity of the Mint was soon, under Mr. Booth's energetic and capable management, enlarged to meet promptly every demand. This time of trial, at the very outset of his Mint career, proved the man and the officer."

There were, naturally, many trying times during the long years that followed the California gold discovery; there were periods of changes in the coinage, changes in method, changes in administration; there were periods of extraordinary losses through the nature of the bullion, as well as from other causes; there were the annual settlements, the annual trials of the pyx, and trials less than annual and more than annual of the nerves of the operative officers—trials such as only devoted servants of a soulless government can understand. But there were many matters of new interest, new study, new relations, new processes to try, to lighten the burdens, relieve the tedium, and divert the mind from a wearying and exhausting sense of its peculiar responsibilities.

A paragraph from Mr. W. E. DuBois's sketch of Mr. Jacob R. Eckfeldt, then Chief Assayer, is in place here as an illustrative bit of history:

"The gold pressure continued for about five years, when it was relieved by the creation of a Government Assay Office in New York, and a Branch Mint at San Francisco. But directly sequent to this came the change of standard in silver coin, causing an immense recoinage in small pieces. Thus our daily assays continued to count by hundreds. This lasted for some years. When it began to slacken off, a law was passed for calling in the large copper coins, and issuing in their stead pieces of copper-nickel

alloy of much smaller size. After this came the substitution of the bronze alloy ; and this called for another process of assay, and brought us a great deal of work."

Among the later improvements in process adopted by Prof. Booth was that of gold-refining. In his letter to the Wastage Commission he says : "I refine usually to 993 and 995 m. and sometimes, to make a finer gold, I heat the alloy of gold and silver with parting acid, so as nearly to separate them, and then heat the residue with oil of vitriol and saltpetre, at a steam heat, by which I have brought the gold to 998 m. The process is my own, and not known outside the Mint." In a paper read before the American Chemical Society and publisht in their Journal (Sept., 1884), he describes some methods of toughening gold and silver. In the same publication (June, 1884), he describes "A General Method of Toughening Gold and Silver in the Melting Crucible ;" and in June, 1885, he printed, in the same Journal, an article on "The Smelting Furnace of the U. S. Mint." At the risk of seeming too technical, I venture to quote a characteristic paragraph from the latter article. "My last improvement, which is still practiced, consists in the very simple operation of melting all the iron residues from the furnaces, even including grate-bars, and keeping them in a quiet melted state, so as to allow the heavier gold and silver to settle out of the iron. When the mass is cold, the precious metal is knockt off the bottom by a hammer as a single tough king, with scarcely a trace of iron in it ; while the iron mass above it has never yielded a trace of gold or silver to the assayer. Instead of spending three weeks, of annual vacation from melting, in hammering tons of accumulated iron, we now melt through the year, whenever convenient, from five to fifty pounds of iron residues at a time. We gathered in one melting, last autumn, a cake of a few ounces of gold and silver from a mass of over fifty pounds of iron in part of a day, and the latter was entirely free from the precious metals. When I first succeeded with this process, I could hardly believe in the perfect separation from iron, and the late Mr. J. R. Eckfeldt, the best assayer in the United States, doubted it, until, by numerous tests made from a piece of some thirty pounds of iron, he found the total absence of gold and silver." It is just to add that Prof. Booth was greatly aided by suggestions from his foreman, Mr. Garrigues, in perfecting this process.

Prof. Booth was a man of varied interests, and of large general culture. He was especially fond of linguistic studies ; and in this domain he long ago made a specialty of phonetics, particularly with reference to shorthand writing, and the reform of English orthography. He took up the study of Isaac Pitman's Phonography, which he pursued with ardor until he mastered it. This of course was more of an achievement forty years ago than it is now. He formed the opinion that this art should be acquired as one of the elementary branches of education. In his judgment, an obstacle to that end lay in the unsatisfactory form of the books of instruction provided for the study. He therefore determined to prepare an elementary work designed to teach the art, and, in 1849, this was pub-

lisht under the title, "Phonographic Instructor; being an introduction to the Corresponding Style of Phonography, with engraved illustrations." This was republisht with a Key in 1850, and again in 1856. The book was based on the inductive method, and an especial merit apart from the clear exposition of principles was in its set of progressive exercises so arranged that nothing once learned had to be unlearned, thus avoiding the discouraging confusion incident to the study as commonly taught. The book was successful, and proved the capacity of its author in elementary instruction.

That Prof. Booth was highly esteemed in social and religious as well as scientific circles is attested by the diversity and duration of his memberships, no less than by his honorary degrees. In 1867 the University of Lewisburg conferred upon him the degree of Doctor of Laws; and, in 1884, the Rensselaer Polytechnic Institute added the Ph.D. to his name. In addition to his memberships already mentioned, he was elected to the Pennsylvania Horticultural Society, in 1842; to the Academy of Natural Sciences, in 1852; to the Maryland Institute for the Promotion of Mechanic Arts, in 1853; to the Philadelphia Society for Promoting Agriculture, about 1859; to the Historical Society of Pennsylvania, in 1884. He was President of the American Chemical Society of New York, in 1883 and in 1884, and declined reëlection for a third term—that honor never having been offered to any of his predecessors. He was Assistant Secretary of the Diocese of Pennsylvania from 1865 to 1871. He was actively interested in various philanthropies. He was one of the Building Committee of Christ Church Hospital. With him and Mr. Joseph E. Hover originated the Seamen's Floating Church of the Redeemer, now on *terra firma* at Front and Queen streets. He was also an active mover in the Children's Hospital connected with the Free Church of the Good Shepherd, at Radnor, Pa.

In addition to the publications already mentioned, Prof. Booth publisht papers "On Beet Root Sugar" (1842); "Chrome Iron Analysis" (1842); "Constitution of Glycerin and Oily Acids" (1848); "Recent Improvements in the Chemical Arts" (1852), and a "Report on the Water Supply of Philadelphia" (1862). He is better known, however, as the editor and annotator of a translation from the French of Regnault's "Elements of Chemistry" (2 vols., Phila., 1853).

Prof. Booth was married November 17, 1853, to Margaret M. Cardeza. His widow and three daughters survive him. Personally, he was a gentleman of refined manners, pleasing address and cheerful disposition. The latter quality was, however, often obscured by his nervous intensity; and a painful anxiety seemed of late years to be ineradicably scored into his very life. His great responsibilities in exact manipulation of millions and millions of dollars in all forms of bullion, for whose safe custody he was also legally accountable, told heavily upon his physical constitution, and left him, long ere the year of his death, a wreck of his former self. Indeed, his noticeable failure dates from the great "wastages" of 1872, together with subsequent difficulties in the recoinage of seventeen millions of our own gold coin in 1873.

The unusual developments in this remelting, the difficulty of obtaining homogeneity, led Prof. Booth to conclude that gold-copper alloys were unstable and subject to segregation. This was contrary to all past experience; and it is due to the scientific world to say that the theory was never accepted in the Assay Department nor (I believe) by the leading experts in the sister Mints of this country. Subsequent experiments show that Prof. Booth's conclusions were based upon a misapprehension. The instability of standard gold-copper alloys has never yet been apparently demonstrated, much less proved; and the theory must be regarded as untenable. But the difficulties alluded to were none the less harassing to the Melter and Refiner, and they workt upon him disastrously.

It is often asserted that the civil service is a bed of roses. But Prof. Booth's shattered constitution and rapid decline, while yet apparently possessed of right to vigor and power, are but another witness to the peculiar wear and tear upon the minds and bodies of many public servants who honor their calling and give dignity and character to their positions. For two or three years past he had seriously contemplated resigning his office; but it was not until August, 1887, that he could bring himself to sever the attachments of thirty-nine years.

Since writing this, a private letter has been shown to me, written by Dr. Booth in October last. I make a few extracts, as follows: "The whole truth is, that the constantly increasing business of the Mint beyond its capacity for bullion storage has been increasingly weighing down my anxious thoughts for its safety, and you may add to that the consciousness that I was personally responsible for every ounce of bullion received, and then you will readily perceive sufficient ground for a constant anxious care, which I sometimes imagined to be as the square or cube of the extra quantity of bullion continually poured in. * * * It was that constant and constantly augmenting ounce-for-ounce responsibility that finally affected my mind, and I rather think broke me down. I went home quite sick from the Mint early in April, and lay on my back for about three months. I suppose that such a statement will be quite sufficient to explain my present position. I am glad to say that I had sufficient strength to resign from my place in the Mint, although no one is yet appointed to take my place. However, I do not go more than once a week to the Mint, and shall be glad when the string of union is severed. * * * From my age, over seventy-seven, I hardly expect restoration of full strength, and am satisfied with what Providence designs."

His resignation was to take effect on the appointment of his successor. But an office demanding such high trust as well as technical knowledge and practical experience was not easy to fill; and before a successor had been found, Death, on March 21, 1888, struck Dr. Booth's name forever from the roll.

He died peacefully. Faith lightened the burden of the last days of a career that has left a name worthily interwoven with the great fabric of the world's onward and upward progress.

The Language of Palæolithic Man.

By Daniel G. Brinton, M.D.

(*Read before the American Philosophical Society, October 5, 1888.*)

Archæologists tell us that the manufacturers of those rude stone implements called palæoliths wandered up and down the world while a period of something like two hundred thousand years was unrolling its eventless centuries. Many believe that these early artisans had not the power of articulate expression to convey their emotions or ideas; if such they had, they were confined to inarticulate grunts and cries.

Haeckel proposed for the species at this period of its existence the designation *Homo alalus*, speechless man. Anatomists have come forward to show that the inferior maxillary bones disinterred in the caves of La Naulette and Schipka are so formed that their original possessors could not have had the power of articulation.* But the latest investigators of this point have reached an opposite conclusion.† We must, however, concede that the oral communication of men during that long epoch was of a very rudimentary character; it is contrary to every theory of intellectual evolution to suppose that they possessed a speech approaching anything near even the lowest organized of the linguistic stocks now in existence. By an attentive consideration of some of these lowest stocks, can we not form a somewhat correct conception of what was the character of the rudimentary utterances of the race? I think we can, but, as I believe I am the first to attempt such a picture, I offer it with becoming diffidence.

The physiological possibility that palæolithic man possessed a language has, as I have said, been already vindicated; and that he was intellectually capable of speech could, I think, scarcely be denied by any one who will contemplate the conception of symmetry, the technical skill, and the wise adaptation to use, manifested in some of the oldest specimens of his art; as for example the axes disinterred from the ancient strata of San Isidro, near Madrid, those found forty feet deep in the post-glacial gravels near

* "L'homme chelleen n' avait pas la parole," Mortillet, *La Prehistorique Antiquité de l' Homme*, p. 250 (Paris, 1883).

† See Dr. H. Steinthal, *Der Ursprung der Sprache*, S. 264, et seq. (Berlin, 1888), who rehearses the discussion of the point with sufficient fullness.

Trenton, New Jersey, or some of those figured by De Mortillet as derived from the beds of the Somme in France.* We have evidence that at that period man made use of fire; that he raised shelters to protect himself from the weather; that he possessed some means of navigating the streams; that he could occasionally overcome powerful and ferocious beasts; that he already paid some attention to ornamenting his person; that he lived in communities; and that his migrations were extensive.† In view of all this, is it not highly improbable that he was destitute of any vocal powers of expressing his plans and his desires? I maintain that we should dismiss the *Homo alalus* as a scientific romance which has served its time.

More than this, I believe that by a judicious study of existing languages, especially those which have suffered little by admixture or by distant removals, we can picture with reasonable fidelity the character of the earliest tongues spoken by man, the speech of the Palæolithic Age.

This primitive utterance was, of course, not the same everywhere. It varied indefinitely. But for all that it is almost certain that in all localities it proceeded on analogous lines of development, just as languages have everywhere and at all times since. By studying simple and isolated languages, those which have suffered least by contact with others, or by alterations in conditions of culture, we can catch some glimpses of the character of man's earliest significant expressions, the "baby-talk of the race," if I may use the expression. I have gleaned a certain number of such traits in the field of American linguistics, and present them to you as curiosities, which, like other curiosities, have considerable significance to those who will master their full purport.

The question I am about to consider, is, you will observe, quite different from that which concerns itself with the origin of *linguistic stocks*. Many of these unquestionably arose long after man had acquired well-developed languages, and when the cerebral convolutions whose activity is manifested in articulate expression had acquired a high grade of development through hereditary training. How such stocks may have arisen has been lucidly set forth by my learned friend Mr. Horatio Hale. He demonstrates by many ex-

* See, for instance, Plate x of Mortillet, *Musée Préhistorique;* Cartailhac, *Ages Préhistoriques de l' Espagne*, plate on p. 27.

† I have collected the evidence for this in an Essay on Prehistoric Archæology, in the *Iconographic Encyclopedia*, Vol. ii.

amples that in the present cerebral evolution of man, infants develop an articulate language with the same natural facility that any other species of animal does the vocal utterances peculiar to its kind.*

But in this essay I am contemplating man as he was before hundreds of generations of speaking ancestors had evolved such cerebral powers.

I begin with some observations on the phonetic elements. These are no other than what we call the alphabet, the simple sounds which combined together make up the words of a language. In all European tongues, the mere letters of the alphabet, by themselves, have no meaning and convey no idea; furthermore, their value in a word is fixed; and thirdly, arranged in a word, they are sufficient to convey its sound and sense to one acquainted with their values.

Judged by certain American examples, all three of these seemingly fundamental characteristics of the phonetic elements were absent in primitive speech, and have become stable only by a long process of growth. We find tongues in which the primary sounds are themselves significant, and yet at the same time are highly variable; and we find many examples in which they are inadequate to convey the sense of the articulate sound.

As exemplifying these peculiarities I take the Tinné or Athapascan, spoken widely in British America, and of which the Apache and Navaho in the United States are branches. You know that in English the vowels A, E, I, O, U, and the consonants, as such, F, S, K, and the others, convey to your mind no meaning, are not attached to any idea or train of ideas. This is altogether different in the Tinné. We are informed by Bishop Faraud,† a thorough master of that tongue, that its significant radicals are the five primitive vowel sounds, A, E, I, O, U. Of these A expresses matter, E existence, I force or energy, O existence doubtful, and U existence absent, non-existence, negation or succession. These vowels are "put in action," as he phrases it, by single or double consonants, "which have more or less value in proportion as the vowel is more or less strong." These consonantal sounds, as we learn at length from the works on this language by Father Petitot, are also materially significant. They are numerous, being sixty-three in

* See his address on "The Origin of Languages and the Antiquity of Speaking Man," in the *Proceedings of the American Association for the Advancement of Science*, Vol. XXXV, p. 279.

† *Dix-huit Ans chez les Sauvages*, p. 85.

all, and are divided into nine different classes, each of which conveys a series of related or associated ideas in the native mind.

Thus, the labials express the ideas of time and space, as age, length, distance, and also whiteness, the last mentioned, perhaps, through association with the white hair of age, or the endless snow-fields of their winter. The dentals express all that relates to force terminating, hence uselessness, inanity, privation, smallness, feebleness; and also greatness, elevation, the motor power. The nasals convey the general notion of motion in repetition; hence, rotation, reduplication, gravitation, and, by a singularly logical association, organic life. The gutturals indicate motion in curves; hence, sinuousness, flexibility, ebullition, roundness, and by a linear figure different from that which underlies the Latin *rectitudo*, justness, correctness. The H, either as an aspirate or an hiatus, introduces the ideas of command and subjection, elevation and prostration, and the like.*

You will observe that in some of these cases the signification of a sound includes both a notion and its opposite, as greatness and smallness. This is an interesting feature to which I shall refer later.

Turn now to another language, the Cree. Geographically it is contiguous to the Tinné; but, says Bishop Faraud, who spoke them both fluently, they resemble each other no more than the French does the Chinese. Nevertheless, we discover this same peculiarity of materially significant phonetic elements. Howse, in his *Cree Grammar*, observes that the guttural K and the labial W, constitute the essential part of all intensive terms in that language, "whether the same be attributive, formative, or personal accident." Indeed, he maintains that the articulate sounds of the Cree all express relative powers, feebleness or force, independent of their position with reference to other sounds.

You may inquire whether in the different groups of American tongues the same or a similar signification is attached to any one sound, or to the sounds of any one organ. If it were so, it would give countenance to those theories which maintain that there is some fixed relation between sound and sense in the radicals of languages. I must reply that I have found very little evidence for this theory; and yet some. For example, the N sound expresses the notion of the *ego*, of myself-ness, in a great many tongues, far

* Petitot, *Dictionnaire de la Langue Dénée Dindjié*, Introduction.

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apart geographically and linguistically. It is the sound at the basis of the personal pronoun of the first person and of the words for *man* in numerous dialects in North and South America. Again, the K sound is almost as widely associated with the ideas of *otherness*, and is at the base of the personal pronoun of the second person singular and of the expressions for superhuman personalities, the divine existences.* It is essentially demonstrative in its power.

Again, in a long array of tongues in various parts of the world the subjective relation is expressed by the M sound, as has been pointed out by Dr. Winkler; and other examples could be added. Many of these it is impossible to attribute to derivation from a

* Without carrying the comparison of the linguistic stocks beyond those most familiar to the ethnologist, I add the following comparisons to confirm the statements of the text:

Dialects in British America.

	I	man	thou	divinity
Eskimo,	wonga	innuit	wootik	
Athapascan,	ni-yun	tinné		
Cree (Algonkian),	ni	iyiṅ	ki	okisikow
Haidah,		e-hlin	tun-ka	
Bilhoola,	insh			
Tshimshian,	neuio			
Kawitshin,	un-sa	enika	ni ki	
Chinook,	ni ka	kah-tin	mi ka	
Shahaptani,	ein uk	wins		

Dialects in the United States.

	I	man	thou	divinity
Lenape (Algonkian),	ni	lenni	ki	oki
Choctaw,	unno		ch-	
Muskoki,	unneh			
Dakota,	on, un, (pl.)			wakan

Dialects in Mexico.

	I	man	thou	divinity
Huasteca,	nana	inic	xaxa	ku
Othomi,	nuga	nyoeh	n'ge	oqha
Nahuatl,	ni			
Tarasca,	ni			
Maya,	in, en	uinic	ech	ku
Zapoteca,	naa			

Dialects in South America.

	I	man	thou	divinity
Qquichua,	noka	khani	kam	huaka
Aymava,	na			huaka
Araucanian,	in-che			
Abipone,	aym		akami	
Carib (dialects),	n		k	

On the astonishingly wide distribution of the *n* and *k* sounds as primitive demonstratives, compare H. Winkler, *Uralaltaische Völker und Sprachen*, s. 86, 87 (Berlin, 1884). For other comparisons, see Tolmie and Dawson, *Vocabularies of Inds. of British Columbia*, p. 128.

common source. Some writers maintain that sounds have a subjective and fixed relation to ideas; others call such coincidences "blind chance," but these should remember that chance itself means merely the action of laws not yet discovered.

You might suppose that this distinction, I mean that between *self* and *other*, between *I, thou* and *he*, is fundamental, that speech could not proceed without it. You would be mistaken. American languages furnish conclusive evidence that for unnumbered generations mankind got along well enough without any such discrimination. One and the same monosyllable served for all three persons and both numbers. The meaning of this monosyllable was undoubtedly "any living human being." Only after a long time did it become differentiated by the addition of locative particles into the notions, "I—living human being," "Thou—living human being," "He—living human being," and so on. Even a language spoken by so cultured a people as the ancient Peruvians bears unmistakable traces of this process, as has been shown by Von Tschudi in his admirable analysis of that tongue; and the language of the Baures of Bolivia still presents examples of verbs conjugated without pronouns or pronominal affixes.*

The extraordinary development of the pronouns in many American languages—some have as many as eighteen different forms as the person is contemplated as standing, lying, in motion, at rest, alone, in company, etc., etc.—this multiplicity of forms, I say, is proof to the scientific linguist that these tongues have but recently developed this grammatical category. Wherever we find overgrowth, the soil is new and the crop rank.

In spite of the significance attached to the phonetic elements they are, in many American languages, singularly vague and fluctuating. If in English we were to pronounce the three words, *loll, nor, roll*, indifferently as one or the other, you see what violence we should do to the theory of our alphabet. Yet analogous examples are constant in many American languages. Their consonants are "alternating," in large groups, their vowels "permutable." M.

* "Es hat offenbar eine Zeit gegeben, in der *ka* alleiniges Pron. pers. für alle drei Personen war, erst allmählich entwickelten sich *ño ka*, ego, *ka m*, tu, *ka y*, ille." J. J. von Tschudi, *Organismus der Khetsua Sprache*, S. 184 (Leipzig, 1884). In the language of the Baures of Bolivia when the verb takes the negative termination *apico*, the pronominal signs are discarded; thus, *era*, to drink, a drink; *erapico* = I, thou, he, we, you, they, do not drink. Magio, *Arte de la Lengua de los Indios Baures*, p. 82 (Paris, 1880). This reveals a time when both affirmative and negative verbals dispensed with pronouns altogether.

Petitot calls this phenomenon "literal affinity," and shows that in the Tinné it takes place not only between consonants of the same group, the labials for instance, but of different groups, as labials with dentals, and dentals with nasals. These differences are not merely dialectic; they are found in the same village, the same family, the same person. They are not peculiar to the Tinné; they recur in the Klamath. Dr. Behrendt was puzzled with them in the Chapanec. "No other language," he writes, "has left me in such doubt as this one. The same person pronounces the same word differently; and when his attention is called to it, will insist that it is the same. Thus, for devil he will give *Tixambi* and *Sisaimbui;* for hell, *Nakupaju* and *Nakapoti.*"* Speaking of the Guarani, Father Montoya says, "There is in this language a constant changing of the letters for which no sufficient rules can be given."† And Dr. Darapsky in his recently published study of the Araucanaian of Chile gives the following equation of permutable letters in that tongue:

B = W = F = U = Ú = I = E = G = GH = HU.‡

The laws of the conversion of sounds of the one organ into those of another have not yet been discovered, but the above examples, which are by no means isolated ones, serve to admonish us that the phonetic elements of primitive speech probably had no fixedness.

There is another oddity about some of these consonantal sounds which I may notice in passing. Some of them are not true elementary sounds; they cannot stand alone, but must always have another consonant associated with them. Thus, the labial B is common in Guarani; but it must always be preceded by an M. In Nahuatl the liquid L is frequent; but it is the initial of no word in that language. The Nahuas apparently could not pronounce it, unless some other articulate sound preceded it.

Albornoz, in his *Grammar of the Chapanec Tongue*§, states that the natives cannot pronounce an initial B, G, Y, or D, without uttering an N sound before it.

The third point in the phonology of these tongues to which I alluded is the frequency with which the phonetic elements as graphi-

* *Apuntes sobre la Lengua Chapaneca, MS.*
† *Arte de la Lengua Guarani,* p. 93.
‡ *La Lengua Araucana,* p. 15 (*Santiago de Chile,* 1883).
§ Albornoz, *Arte de la Lengua Chapaneca,* p. 10.

cally expressed, are inadequate to convey the idea. I may quote a remark by Howse in his *Cree Grammar*, which is true probably of all primitive speech, "Emphasis, accent and modifications of vocal expression which are inadequately expressed in writing, seem to constitute an essential, perhaps the vital part of Indian language." In such modifications I include tone, accent, stress, vocal inflection, quantity and pause. These are with much difficulty or not at all includable in a graphic method, and yet are frequently significant. Take the pause or hiatus. I have already mentioned that in Tinné it correlates a whole series of ideas. M. Belcourt, in his Grammar of the Sauteux, an Algonkin dialect, states that the pause may completely change the meaning of a word and place it in another class; it is also essential in that language in the formation of the tenses.* This is the case in the Güarani of South America. Montoya illustrates it by the example: *Peru o'u*, Peter ate it; but *Peru ou*, Peter came; quite another thing you will observe.†

The stress laid on a vowel-sound often alters its meaning. In the Sauteux, Belcourt points out that this constitutes the only distinction between the first and second persons in participles. In the Nahuatl this alone distinguishes many plural forms from their singulars; and many similar examples could be cited.

With difficulties of this nature to encounter, a person accustomed to the definite phonology of European tongues is naturally at a loss. The Spanish scholar Uricoechea expresses this in relating his efforts to learn the Chibcha of New Granada, a tongue also characterized by these fluctuating phonetics. He visited the region where it is still spoken with a grammar and phrase book in his hand, and found to his disappointment that they could not understand one word he said. He then employed a native who spoke Spanish, and with him practiced some phrases until he believed he had them perfect. Another disappointment. Not one of them was understood. He returned to his teacher and again repeated them; but what was his dismay when not even his teacher recognized a single word! After that, Uricoechea gave up the attempt.‡

Leaving now the domain of phonology and turning to that of lexïcography, I will point out to you a very curious phenomenon in primitive speech. I have already alluded to it in quoting M. Peti-

* *Principes de la Langue des Sauvages appellés Sauteux.* Introd.
† *Arte de la Lengua Guarani, ó mas bien Tupi.* Por el P. Antonio Ruiz de Montoya, p. 100.
‡ *Gramatica de la Lengua Chibcha.* Introd.

tot's remark that in Tinné a sound often means both a notion and its opposite; that, for instance, the same word may express good and bad, and another both high and low. To use M. Petitot's own words, "a certain number of consonants have the power of expressing a given order of ideas or things, and also the contradictory of this order." In Tinné, a great many words for opposite ideas are the same or nearly the same, derived from the same significant elements. Thus, *son* good, *sona* bad; *tezo*, sweet, *tezon* bitter; *ya* immense, *ya* very small; *inla* one time, *inlasin* every time; and so on.

This union of opposite significations reappears in the ultimate radicals of the Cree language. These, says Mr. Howse,* whose *Grammar* I again quote, express *Being* in its positive and negative modes; "These opposite modes are expressed by modifications of the same element, furnishing two classes of terms widely different from each other in signification." In Cree the leading substantive radical is *eth*, which originally meant both Being and Not-Being. In the present language *eth* remains as the current positive, *ith* as the current privative. *It* means within, *ut* without; and like parallelisms run through many expressions, indicating that numerous series of opposite ideas are developments from the same original sounds.

I have found a number of such examples in the Nahuatl of Mexico, and I am persuaded that they are very usual in American tongues. Dr. Carl Abel has pointed out many in the ancient Coptic, and I doubt not they were characteristic of all primitive speech.

To explain their presence we must reflect on the nature of the human mind, and the ascertained laws of thought. One of these fundamental and necessary laws of thought, that usually called the second, was expressed by the older logicians in the phrase *Omnis determinatio est negatio*, and by their modern followers in the formula, "*A* is not *not-A*;" in other words, a quality, an idea, and element of knowledge, can rise into cognition only by being limited by that which it is not. That by which it is limited is known in logic as its privative. In a work published some years ago I pointed out that this privative is not an independent thought, as some have maintained, but that the positive and its privative are really two

* See Howse, *Grammar of the Cree Language*, pp. 16, 134, 135, 169, etc.

aspects of the same thought.* This highly important distinction explains how in primitive speech, before the idea had risen into clear cognition, both it and its privative were expressed by the same sound; and when it did rise into such cognition, and then into expression, the original unity is exhibited by the identity of the radical. Thus it happens that from such an unexpected quarter as an analysis of Cree grammar do we obtain a confirmation of the starting point of the logic of Hegel in his proposition of the identity of the *Being* and the *Not-being* as the ultimate equation of thought.

The gradual development of grammar is strikingly illustrated in these languages. Their most prominent trait is what is called *incorporation.* Subject, verb, direct object and remote object are all expressed in one word. Some have claimed that there are American languages of which this is not true; but I think I have shown in an essay published a few years ago,† that this opinion arises from our insufficient knowledge of the alleged exceptions. At any rate, this incorporation was undoubtedly a trait of primitive speech in America and elsewhere. Primitive man, said Herder, was like a baby; he wanted to say all at once. He condensed his whole sentence into a single word. Archdeacon Hunter, in his "*Lecture on the Cree Language,*" gives as an example the Scriptural phrase, "I shall have you for my disciples," which, in that tongue, is expressed by one word.‡

So far as I have been able to analyze these primitive sentence-words, they always express *being in relation;* and hence they partake of the nature of verbs rather than nouns. In this conclusion I am obliged to differ with the eminent linguist Professor Steinthal who, in his profound exposition of the relations of psychology to grammar, maintains that while the primitive sentence was a single word, that word was a noun, a name.§

It is evident that the primitive man did not connect his sentences. One followed the other disjointedly, unconnectedly. This is so

* *The Religious Sentiment; Its Source and Aim. A Contribution to the Science of Religion.* By D. G. Brinton, p. 31 (New York, 1876). The statement in the text can be algebraically demonstrated in the mathematical form of logic as set forth by Prof. Boole, thus: $A =$ not (not - A); which, in its mathematical expression becomes, $x = x^2$. Whence by transposition and substitution we derive, $x^2 = 1$; in which equation $1 = A$. See Boole, *An Investigation into the Laws of Thought* (London, 1854).

† *On Polysynthesis* and *Incorporation,* in *Proceedings* of the American Philosophical Society, 1885.

‡ *On the Grammatical Construction of the Cree Language,* p. 12 (London, 1875).

§ Steinthal, *Gramatik, Logik und Psychologie,* s. 325.

plainly marked in American tongues that the machinery for connecting sentences is absent. This machinery consists properly of the relative pronoun and the conjunction. You will be surprised to hear that there is no American language, none that I know, which possesses either of these parts of speech. That which does duty for the conjunction in the Maya and Nahuatl, for instance, is a noun meaning associate or companion, with a prefixed possessive.*

Equally foreign to primitive speech was any expression of *time* in connection with verbal forms; in other words, there was no such thing as tenses. We are so accustomed to link actions to time, past, present, or future, that it is a little difficult to understand how this accessory can be omitted in intelligible discourse. It is perfectly evident, however, from the study of many American tongues that at one period of their growth they possessed for a long interval only one tense, which served indifferently for past, present, and future;† and even yet most of them form the past and future by purely material means, as the addition of an adverb of time, by accent, quantity or repetition, and in others the tense relation is still unknown.‡

In some tongues, the Omagua of the upper Orinoco for example, there is no sort of connection between the verbal stem and its signs of tense, mode or person. They have not even any fixed order. In such languages there is no difference in sound between the words for "I marry," and "my wife;" "I eat," and "my food," between "Paul dies," "Paul died," "Paul will die," and "Paul is dead."§ Through such tongues we can distinctly perceive a time when the verb had neither tense, mode, nor person; when it was not even a verb nor yet a verbal, but an epicene sound which could be adapted to any service of speech.

* In Maya the conjunction "and" is rendered by *yetl*, a compound of the possessive pronoun, third person, singular *y*, and *etl*, companion. The Nahuatl, *ihuan*, is precisely the same in composition.

† Die meisten amerikanischen Sprachen haben die Eigenthümlichkeit, dass in der Regel die Haupttempora in Anwendung kommen und unter diesen besonders das Präsens, selbst wenn von einer bestimmten, besonders aber von einer unbestimmten Vergangenheit gesprochen wird. J. J. von Tschudi, *Organismus der Khetsua Sprache*, s. 198. The same tense is also employed for future occurrences. What classical grammarians call "the historical present," will illustrate this employment of a single tense for past and future time.

‡ The Chiquita of Bolivia is an extreme example. "La distinction du passé, du présent et du futur n'existe pas dans cette langue étrange." *Arte y Vocabulario de la Lengua Chiquita.* Por L. Adam, y V. Henry, p. x.

§ *On the Verb in American Languages.* By Wilhelm von Humboldt. Translated by D. G. Brinton, in *Proceedings of the American Philosophical Society*, 1885.

It is also evident that things were not thought of, or talked of, out of their natural relations. There are still in most American tongues large classes of words, such as the parts of the body and terms of kinship, which cannot stand alone. They must always be accompanied by a pronoun expressing relation.

Few American tongues have any adjectives, the Cree, for instance, not a dozen in all. Prepositions are equally rare, and articles are not found. These facts testify that what are called "the grammatical categories" were wholly absent in the primitive speech of man.

So also were those adjectives which are called *numerals*. There are American tongues which have no words for any numerals whatever. The numerical concepts one, two, three, four, cannot be expressed in these languages for lack of terms with any such meaning.* This was a great puzzle to the missionaries when they undertook to expound to their flocks the doctrine of the Trinity. They were in worse case even than that missionary to an Oregon tribe, who, to convey the notion of *soul* to his hearers, could find no word in their language nearer to it than one which meant "the lower gut."

A very interesting chapter in the study of these tongues is that which reveals the evolution of specific distinctions, those inductive generalizations under which primitive man classified the objects of the universe about him. These distinctions were either grammatical or logical, that is, either formal or material. That most widely seen in America is a division of all existences into those which are considered living and those considered not living. This constitutes the second great generalization of the primitive mind, the first, as I have said, having been that into Being and Not-being. The distinctions of Living and Not-living gave rise to the *animate* and *inanimate* conjugations. A grammatical sex distinction, which is the prevailing one in the grammars of the Aryan tongues, does not exist in any American dialect known to me.†

It is true that abstract general terms are absent or rare in the

* A striking example is the Chiquita of Bolivia. "No se puede en chiquito, ni contar dos, tres, cuatro, etc., ni decir segundo, tercero, etc." *Arte y Vocabulario de la Lengua Chiquita*, p. 19 (Paris, 1880).

† Those distinctions, apparently of sex, called by M. Lucien Adam *anthropic* and *metanthropic*, *arrhenic* and *metarrhenic*, found in certain American tongues, belong to the material, not the formal part of the language, and, strictly speaking, are distinctions not really based on sexual considerations. See Adam, *Du Genre dans les Diverses Langues* (Paris, 1883).

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most primitive tongues. On the other hand, we find in them a great many classificatory particles. These correspond only remotely to anything known in Aryan speech, and seem far more abstract than generic nouns. I will illustrate what they are by an example taken from the Hidatsa, a dialect of the Dakota.

The word for sled in that dialect is *mida-maidutsada*. The first part of this compound, *mida*, means anything of wood or into which wood enters. Fire is *midé* because it is kept up with wood. With the phonetic laxity which I have before noted, the first syllable *mi* may as correctly be pronounced *bi* or *wi*. It is a common nominal prefix, of vague significance, but seems to classify objects as distinctives. *Ma* designates objects whose immediate use is not expressed; *I* denotes instrument or material; *du*, conveys that the cause of the action is not specified; *tsa* intimates the action is that of separating; *da*, that this is done quickly (*tsa-da*, to slide).*

Thus by the juxtaposition of one classificatory particle after another, seven in number, all of them logical universals, the savage makes up the name of the specific object.

This system was probably the first adopted by man when he began to set in order his perceptions within the categories of his understanding with the aim of giving them vocal expression. It is a plan which we find most highly developed in the rudest languages, and therefore we may reasonably believe that it characterized prehistoric speech.

The question has been put by psychological grammarians, which one of the senses most helped man in the creation of language, or to express it in modern scientific parlance, was primitive man a *visuaire* or an *auditaire?* Did he model his sounds after what he heard, or what he saw? The former opinion has been the more popular, and has given rise to the imitative or "onomatopoetic" theory of language. No doubt there is a certain degree of truth in this, but the analysis of American tongues leans decidedly toward classing primitive man among the *visuaires*. His earliest significant sounds seem to have been expressive of motion and rest, energy and its absence, space and direction, color and form, and the like. A different opinion has been maintained by Darwin and by many who have studied the problems presented by the origin of words from a merely physical or physiological standpoint, but a careful investi-

* Washington Matthews, *Grammar and Dictionary of the Language of the Hidatsa* (New York, 1873).

gation shows that it was the sense of sight rather than of hearing which was the prompter to vocal utterance. But the consideration of the source of primitive significant sounds lies without the bounds of my present study.

It will be seen from these remarks that the primitive speech of man was far more rudimentary than any language known to us. It had no grammatical form; so fluctuating were its phonetics and so much depended on gesture, tone, and stress, that its words could not have been reduced to writing, nor arranged in alphabetic sequence; these words often signified logical contradictories, and which of the antithetic meanings was intended could be guessed only from the accent or a sign; it possessed no prepositions nor conjunctions, no numerals, no pronouns of any kind, no forms to express singular or plural, male nor female, past nor present; the different vowel-sounds and the different consonantal groups conveyed specific significance, and were of more import than the syllables which they formed. The concept of time came much later than that of space, and for a long while was absent.

Obituary Notice of Philip H. Law, Esq. By Daniel G. Brinton, M.D.

(Read before the American Philosophical Society, October 19, 1888.)

In one of the conversations of his later life, Goethe said, that some of the most remarkable men whom he had met in his career had never acquired distinction in any line of effort. Something of the same kind is stated by Hugh Miller, the geologist, in his "Autobiography." I am reminded of these expressions in preparing a biographical notice of our late member, Mr. Philip H. Law. Those who knew him best will, I think, agree with me in pronouncing him a remarkable man; although it is difficult to point to anything that he accomplished which would justify the epithet. This lack of accomplished deeds may in part be explained by the circumstances of his life. He was the only son of parents enjoying pecuniary ease, and as he never married he lacked that potent stimulus to effort—necessity.

His birth took place in Baltimore, February 17, 1839. When he was about eight years of age, the family removed to Philadelphia, where Mr. Law resided the rest of his life, rarely leaving the city even in summer for a single day. Some of his youthful experiences were in the office of his father, who was a broker, and the glimpses he there obtained of Third street methods were never forgotten by him.

His earlier education was completed at the University of Pennsylvania, and a few years later he was admitted to the bar, which was his ostensible profession for the rest of his life. In later years he paid but little attention to it, preferring to give his hours to general reading and intellectual conversation. Legal practice was distasteful to him, though I am informed by those more capable of judging than myself, that his knowledge of the theory of the law was sound and extensive. He was well versed in certain branches of it rarely explored by ordinary lawyers, for instance, the Roman and Norman codes, and the history of the development of English Common Law and Procedures.

Mr. Law had a remarkably retentive memory and I cannot now recall any person of my acquaintance who surpassed him in a knowledge of general prose literature. On various occasions when I had been attracted by some little-known author I would air my newly acquired knowledge in his presence and would usually find that he had dipped more or less deeply into the volumes. Thus, on one occasion I had been looking up the life and works of Charles von Bonstetten, sufficiently little known in this country, but I found he was no stranger to my friend Law. At another time we tried him with Jomini's works on the art of war; but he was singularly familiar with them. Such examples were constant.

He had read extensively in the memoirs and biographies of the seventeenth and eighteenth centuries, both French and English. His knowledge of the former language was lexicographically good, and he had kept up and increased his knowledge of Latin imbibed at college, and perused the Roman authors frequently.

To one branch of literature he always manifested an aversion. This was poetry, especially its modern forms. I once persuaded him to read aloud Swinburne's "Our Lady of Seven Sorrows." He did so with "good accent and good discretion," but at the close threw the volume aside with an expression of contempt. This aversion I attribute to a natural and cultivated predominance of the intellectual over the emotional elements of character. He once informed me that never, even as a youth, did he have the common experience of falling in love. His family and friendly affections, which were strong, were directed by natural sympathies, or by a sense of duty, rather than by unconscious emotion.

To the claims of music he was even more indifferent. Of this art he was accustomed to say that it should be placed on a level with cookery, the one titillating the palate, the other the ear, neither conveying any ideas to the intellect; at most, perhaps, like Plato, he might have conceded that music is useful in teaching boys proper etiquette.

His sense of truth was keen, and I have often heard him inveigh against the modern historians who strive to conceal the discredible sides of their heroes' characters. He held up as a model for all biographers the immortal pages of Plutarch, who never hesitates to reveal the vanity of a Cæsar, the meanness of a Cato, or the adulteries of an Alcibiades. I never met a man who more clearly perceived than did Law that the cause of

truth and justice is not benefited by lying, even that quasi-lying which consists in the deliberate concealment of the truth.

In business matters his judgment was sound and clear, and I and others of his friends benefited much by his advice. He laughed at those who suppose that abstract studies disqualify for dealings with men, and quoted Schopenhauer's reply when some one expressed surprise at his business ability: "Do you think because I am a philosopher, that I am therefore a fool?"

In his conversational powers, Law was a marked figure when he chose to give them play. This he rarely did in a large company. At such times he was apt to remain silent. But it was the reverse among those with whom he felt sure he would not be misunderstood. Then, indeed, the complaint might be that he would monopolize the conversation. His style was somewhat Johnsonian, crowding down less voluble speakers, but himself saying what the company generally wished to listen to. For some years he was a conspicuous member of a small association of men who desired to turn their minds to subjects higher than the affairs of daily life, an association which ambitiously styled itself "The Philosophers." Whatever else we learned in that assembly, we did not discover the elixir of life, for the association became extinct in a few years.

He was not gifted as a public speaker, and it was rare that he occupied the time of the various learned societies of which he was a member. He was, however, an appreciative listener and there were few topics of modern research in which he did not take an intelligent interest. He occupied a position as an officer in this and other societies, and was always prompt and careful in the performance of any duties thus imposed upon him.

While an omnivorous reader, he had some topics of predilection. One of these was metaphysics. He had been educated in the usual doctrines of one of the Protestant denominations, but, as he told me on one occasion, had his intellectual slumber broken by reading Sir William Hamilton's celebrated treatise on the "Philosophy of the Unconditioned." He learned later that Hamilton's views are really little more than an expansion of Kant's famous antinomies of the human understanding, and Law agreed with Lewes in the opinion that that wonderfully acute critique destroyed forever the foundation of all speculative philosophy. That Kant avoided this conclusion, he characterized as subservience to authority; that Hamilton did not push his theory to this extent, he attributed to timidity; and that Hegel pretended to have framed a new logic which avoided it, was a claim in his opinion proved false by its failure.

By this ratiocination Mr. Law was led toward the Comtian doctrines, which he studied with much care. They persuaded him that that philosophy known as the Positive is alone the body of principles which are consistent with the demands of modern science and social relations. In the many discussions I had with him on this topic I could never gain any concessions from him in favor of the idealistic or even the monistic doc-

trines. What to me seemed the abstractly true, as for instance, the formulæ of the higher mathematics, he rejected, in accordance with the tenets of the Positivists, as merely formal and not real expressions, *idolæ fori et scholæ;* yet with native intellectual fairness, he clearly saw and freely acknowledged that the Platonic doctrine of archetypal ideas, if it could be established, would be a far grander cosmic conception than Positivism presents. But he insisted on the total illogicality of the evidence in its favor.

His favorite authors in this domain were Aristotle, Bacon, Hobbes, Locke and Hume. He did not, as many, speak of these great names through reviews, encyclopedias, and other second-hand sources of information, but from frequent and attentive perusal of their works. To him, this long line of rationalistic thinkers expressed the sober, sound and real intellectual advance of the race, holding man's mind down to what he can certainly know, and dismissing as vain and hurtful all pretended intuitions, inspirations, and emotional imaginings.

Consistently with this dismissal of the pursuit of primary causes—the search for the unsearchable—he welcomed the Darwinian hypothesis of transformation as a complete and satisfying explanation of the phenomena of organic life by the assignment of known and intelligible proximate causes. Though little interested in natural history, he was well acquainted on its philosophic side with the great controversy over evolution.

That marvelous genius, Pascal, spent the latter years of his life in preparing material for a work on the grandeur and the baseness of human nature. Mr. Law fully appreciated this seeming paradox. His estimate of the conscious motives of men was very low. He held that greed, lust, hatred, vanity and self-interest are the prime movers in most deliberate actions; but he also constantly pointed out the enormous personal sacrifices which most men make, unconsciously or nearly so, for their families and their country. He was unwilling to acknowledge motiveless evil in human nature. I once asserted that some men take an innate pleasure in witnessing pain. He warmly denied this, and maintained that such an opinion arose from an incomplete analysis of the fact.

The study of ethics had particular attractions for him, and he had familiarized himself with the leading treatises on that branch, from Aristotle down. He delighted, with all the zest of Montaigne, to point out the mutations of the ethical standards in different periods and climes. He loved extreme examples; as that in ancient Persia it was a particularly meritorious deed for a son to take his own mother to wife; or that to-day in India, prostitution is a sacred profession. Consequently he regarded all ethical prescriptions as of temporary force only. In one conversation he summed them up under three heads: National ethics, which defines the rights of men in communities and are roughly synonymous with the laws of the commonwealth; Social ethics, in which is included all that pertains to etiquette and good breeding; and Personal ethics, which embraces the care of the person, and prudence and foresight with regard to

one's own needs. This classification impressed me as comprehensive and just, and was, I am quite sure, original with him.

The amelioration of society in modern times he explained as due to the evolution of the benevolent emotions and of the sense of justice through enlarged social relations, and not to religious dogmas. All such dogmas and doctrines he looked upon as transient forms of man's intelligence in its progressive development toward clear materialism, which teaches that beyond the properties of matter, its elements and laws, there is nothing. Such an opinion may in the future prove to be the ripened fruit of the tree of knowledge; or new discoveries in the field of psychic research may pronounce it narrow and fallacious. No mortal can say. At present, the advocates of such tenets are few, and their presentation unwelcome, especially in this country. A considerable degree of moral courage is required to maintain them, and this should always be placed to the credit of those who conscientiously attach themselves to a small and unpopular minority.

Finding his pleasure almost exclusively in such studies, themes purely of the intellect, he cared little for the beautiful in art or nature. He quoted with approbation Dr. Johnson's reply when asked to stroll through the fields near London, "Let us walk down the Strand; let us see *men*." Equally indifferent was he both to what is called society, and to the games and amusements in which most men pass their leisure. I never knew him to take a drive for pleasure, nor to play a game of cards or billiards, nor to go gunning or fishing, nor to attend a concert, nor to visit a picture gallery. Through this narrowness of his tastes he became almost a recluse in his later years, and was frequently misunderstood by those whom he did meet. He devoted his time to reading, being of the opinion of Lord Bacon, that "Reading is converse with the wise; but action is, for the most part, commerce with fools."

Law was averse to the labor of composition. He prepared a few papers for reading before the Numismatic and Antiquarian Society, whose meetings he attended with regularity, but I believe nothing he wrote was published in full. Most of these papers were descriptive of historic sociological conditions, either in this country or in Europe. Mr. Isaac Myer, the competent historiographer of the Numismatic and Antiquarian Society, has given their titles, together with a number of genealogical and biographical details in the necrology of Mr. Law which he laid before that Society.

Such limited results of a life of leisure mainly devoted to literary and historical study is a phenomenon common enough in this age. It was not altogether due to indolence or timidity. The pursuit of fame, pronounced a disease by Milton, and overtly despised by Shakespeare, becomes the most trivial of motives to one who is accustomed to compare the momentary duration of human life with the infinite measures of time and space. All his intimate friends know that this was a familiar topic of

conversation to Law, and undoubtedly on him it reacted disastrously, as it did on Amiel, whose *Journal Intime* bears constant traces of it.

Our friend was a lover of good cheer, but it was far from filling the requirements of his nature. No one could content himself with humbler fare or cared less to pamper himself with luxuries. Yet no one appreciated more highly the delights of a nobly spread board, and the merits of a bottle of sound wine, when combined with friendly companionship and intellectual conversation. Any one capable of appreciating the best qualities of heart and mind, who met Mr. Law at such times, could not fail of bearing away sentiments of affection and respect for him.

He was careless with reference to dress, and this not only as matter of habit, but of avowed principle. He shared Carlyle's contempt for clothes, and maintained that for a man to attach much importance to his garb is a sign of mental backwardness. He referred to the picturesque and beautiful costumes of men of past centuries, and explained their disappearance as a mark of evolution. That women are as devoted as ever to such fine feathers he adduced as evidence in favor of his avowed belief in their mental inferiority as a sex. He was an earnest advocate of the virile power, as against feminine influence. He thoroughly agreed with Thackeray's opinion, as expressed in "Henry Esmond," that a man or a country ruled by the influence of priests or women is on the high road to decadence.

In politics Mr. Law was a Democrat, and in political economy a Free-trader. These were not merely inherited opinions. He had read very widely the authors on modern political history, and set forth clearly both the many fallacies of the protective theory as a national policy and also that it is in open conflict with the brotherhood of man. The doctrine that each nation should take care of its own interests, without reference to its neighbors, he characterized as on the same level of morals as the common expression, "Every man for himself and the devil take the hindmost," both absolutely at issue with the grand Comtian motto, *Vivre pour autrui*. Altruism, he contended, is the highest moral principle both for the individual and the State, and its repudiation by either will work no ultimate good result. National selfishness he condemned as just as unphilosophical, and for that matter just as un-Christian, as individual selfishness.

At the time of his death, Mr. Law was not yet fifty; but he had already reached an age greater than the average of his male ancestors in either branch as far as they could be traced. None had attained advanced years, and thoroughly acquainted as he was with the doctrine of heredity as applied to longevity, he did not flatter himself with the expectation of long life. When I left for Europe in February last, he expressed serious doubts whether he would be alive on my return, as he was not. This anticipation was not owing to physical debility. He was of a large, powerful frame, weighing about 210 pounds, and had never been sick except on one occasion, from a temporary surgical affection. His death was sud-

den. On the morning of the 22d of May he fell dead in the street from heart disease or apoplexy, it is not known which.

We have lost in him a member who, perhaps, more than any one of us, deserved to be an associate in a *Philosophical* society, and one whose philosophy, however different from that popular in this community, prompted him all his life to be an affectionate son and brother, a warm and sympathetic friend, and a man of honorable instincts.

On the Attachment of Platyceras to Palæocrinoids, and its Effects in Modifying the Form of the Shell.

By Charles R. Keyes.

(*Read before the American Philosophical Society, October 19, 1888.*)

Attention has lately been called to the sedentary habits of *Platyceras*,* and to the variable configuration of the apertural margin in different individuals of the same species—the confirmatory evidence being partly from analogy among living forms closely allied to the fossil ; partly, and more directly, by the actual occurrence of various *Platycerata* attached to palæozoic crinoids. The association of these gasteropods with the crinoids had long been known, but prior to the recent discovery of a rich crinoidal fauna in the Keokuk rocks of Indiana illustrative examples of this kind were numerically very limited. The recorded instances of such findings have usually been accompanied by more or less brief explanatory remarks, but until 1868† the interpretations were for the most part incorrect, chiefly on account of erroneous conceptions relative to the functions of various organs in the crinoid. It was, however, noted that the molluscan shells were nearly always on the ventral side of the crinoid in the proximity of the vault opening and encompassed by the arms—a fact which was thought to afford conclusive proof of the carnivorous habits of the crinoids, which were, at the moment of perishing, in the act of devouring the mollusks. The examination of several fossil crinoids having shellfish inclosed by the arms led the Austins‡ to some general conclusions relative to the food of all the crinoids; and they give a vivid though highly imaginary account of the capture of *Producti* and univalves by the "rapacious" echinoderm. Another explanation of this phenomenon was subsequently advanced to the effect that the gasteropods were parasitic in their habits, but this also now appears to require considerable emendation. Later investigations among recent and fossil crinoideans show that the food of the species now extant consists in great part of animalcules and microscopic

* Keyes, Am. Jour. Sci., Vol. xxxvi, p. 269, 1888.
† Meek and Worthen, Proc. Acad. Nat. Sci. Phila., 1868, p. 340.
‡ Monog. Recent and Fossil Crinoidea, p. 73, 1843.

plants; that in the palæocrinoids* the mouth is subtegumentary, instead of being externally visible as in the recent crinoids, and that the aperture in the vault is the anal opening. With these considerations in view the association of these calyptræan shells and palæozoic crinoids assumes an entirely different phase from that originally entertained.

The genus *Platyceras* was founded by Conrad† in 1840 for a palæozoic group of gasteropodous shells "suboval or subglobose, with a small spire, the whorls of which are sometimes free and sometimes contiguous; the mouth generally campanulated or expanded." Hitherto these fossil shells had been referred to the genus of modern mollusca *Capulus*, proposed by Montfort‡ in 1810; or to *Pileopsis*, founded by Lamarck§ in 1822 for the same group. Conrad's name for this fossil group was not, until within the past few years, generally accepted, preference having been given by most European writers, and also by some American authors, to *Acroculia* of Phillips,‖ notwithstanding the fact that the type of Phillips' genus was a typical form of *Platyceras*. Some European writers even now question the propriety of generically separating *Platyceras* from *Capulus*, and continue to describe specimens belonging to the former group under the latter genus. Among living *Calyptræidæ* it has been observed that both color and form are dependent upon individual environment and hence in forms of the same species there may be many varietal phases. It has further been noted that the majority of the members of this family attach themselves while yet quite young to stones and shells of other mollusca, and having found a suitable situation seldom, if ever, remove from the spot where first they became stationed. The character and contour of the surface on which they have settled would therefore determine to a great extent the form and outline of the apertural margin. The evidence here presented manifestly proves that the fossil representatives had, with perhaps one exception, similar habits and were subjected to like conditions of environment.

I. History.

1843. Among the first to note the intimate connection of molluscan shells and crinoids were the Austins,¶ who, in their description of *Poteriocrinites crassus*, discuss at length the "carnivorous" propensities of the crinoids in general. Particular mention is made of *Producti* being the victims of the "predatory explorations" of the *Poteriocrini;* and there is reference also to "other crinoids having been found with univalves inclosed within their rays, in such a position as to leave but little

*It must be borne in mind that *palæocrinoidea* and *palæozoic crinoidea* are not coextensive terms.

†Ann. Rept. Palæo. N. Y., p. 205, 1840.

‡Conch Syst., Vol. ii.

§His. Nat. des Animaux sans Vertèbres, 1815–1822.

‖Palæ. Foss. Cornwall, p. 93, 1841.

¶Monog. Recent and Fossil Crinoidea, p. 73.

doubt that a sudden death had overtaken them in the midst of their repast."

1844. De Koninck,* though possessing no specimens in which these gasteropods were associated with crinoids and probably having in mind living forms, states that in consequence of the habits which the animals of this genus (*Capulus*) have of attaching themselves to foreign bodies and remaining fixed during life, the margins of the shells become adapted to all the irregularities of the surface in contact.

1847. In America the first mention of the association of *Platyceras* and fossil crinoids was by Yandell and Shumard.† The specimen they refer to was afterwards described by the former as *Acrocrinus shumardi.* These authors seemed to have adopted the views of the Austins, and remark that they believe "the carnivorous habits of the crinoideans have been clearly made out."

1851. L. P. Yandell,‡ in a paper On the Distribution of the Crinoidea in the Western States, corroborates the statement made four years previous, and is "satisfied as to the carnivorous habits of the crinoidea." At Cincinnati he noticed several specimens of *Glyptocrinus decadactylus* Hall with gasteropods entangled in the arms. Reference is also made to a *Platycrinus* from Warsaw, Ill., and several specimens of *Actinocrinus*§ with *Platycerata* attached.

1855. Yandell‖ described and figured *Acrocrinus shumardi* with a *Platyceras* attached to the vault. It is the same specimen referred to by Yandell and Shumard in 1847, and the views there expressed are here repeated.

1862. Richard Owen¶ considered that the *Platycerata* constituted the principal food of certain crinoids and therefore gave without description the name *Platyceras pabulocrinus* to a gasteropod found on *Platycrinus hemisphæricus.*

1866. In Meek and Worthen's discussion** of the genus *Platyceras* two paragraphs are devoted to the consideration of the probable habits of the species of this group. An instance is cited in which the calyptræan shell is attached to the side of a *Pentremites godoni* so as to entirely cover one of the pseudo-ambulacral fields and two of the intermediate areas, the line of contact being such as could not have resulted from accidental pressure. The improbability of the earlier views that the crinoids were in the act of devouring the gasteropods is here clearly shown.

1867. H. Trautschold†† figured and described *Capulus parasiticus* on

* Desc. des Anim. Foss. (de Belgique), p. 332, 1842–4.

† Contributions Geol. Kentucky, p. 25, 1847.

‡ Proc. Am. Asso. Adv. Sci. 1851, p. 234.

§ Actinocrinus as then used has since been subdivided into a number of genera.

‖ Amer. Jour. Sci., (2), Vol. xx, p. 135.

¶ Geol. Surv. Indiana, p. 364, 1862.

** Geol. Illinois, Vol. iii, p. 384.

††Einige Crin. und andere Thierreste des Jüngeren Bergkalks im Gouv. Moskau, p. 41, 1867.

Cromyocrinus simplex. He remarks that the gasteropod was attached to the anal plate crowded between the arms of the crinoid, and that very probably the *Capulus* was dependent for its food upon the crinoid, or perhaps fed upon the excrementitious matter. The closely allied *Cromyocrinus gemmatus* had not been found with the *Capulus* affixed.

1868. Meek and Worthen* in their notes on the Structure and Habits of the Palæozoic Crinoids refer to the attachment of *Platycerata* to two species of Crawfordsville, Ind., crinoids. Their remarks also appear in the American Journal of Science† and in the report of the Illinois Geological Survey.‡ The somewhat prolix discussion there presented, however, is directed more toward the real functions of the vault aperture in the crinoid than to the *Platyceras* itself. Special mention is made of *Platycrinus hemisphæricus* Meek and Worthen and *Ollacrinus tuberosus* Lyon and Casseday from the Keokuk of Indiana. It was observed that *Platyceras infundibulum* M. & W. was usually attached to the former species, and that the anterior side of the mollusk was always directed upward, while in regard to the latter species "it is worthy of note, that it is always another, subspiral, *Platyceras* (very similar to *P. æquilaterum*) that we find attached to this crinoid, so that here, at least, it would seem that each of these two crinoids has its own particular species of *Platyceras.*" It is also here shown that the contact of the gasteropod and crinoid is more than transient, as the sinuosities of the margin of the shell is adapted exactly to the irregularities of the surface of the crinoid.

1869. E. Billings§ in answering some objections urged against his views on the structure of the crinoidea, etc., supposes that when the *Platyceras* covers the ventral opening, which he regards as the mouth, there must have been space left for a stream of water to pass under the edge of the shell into the mouth of the crinoid. He adds: "The view I took of the subject in my paper was that the gasteropod ascended the stalk of the crinoid and thrust its proboscis into the mouth of the latter. The crinoid then slowly drew its arms together and held the shell fast until both died."

1879. Wetherby,‖ describing some new species of crinoids from the Kaskaskia group of the Subcarboniferous, states that all of the specimens of *Pterotocrinus acutus* Weth. and *P. bifurcatus* Weth. have a gasteropod resting on the vault.

1879. H. Trautschold¶ figured and redescribed *Cromyocrinus simplex* Trauts. with a Platyceras attached. He suggests that the process on the anal side was built by the crinoid for protection against the parasitic mollusk, but adds that the gasteropod may have fed on the refuse matter of the crinoid.

* Proc. Acad. Nat. Sci. Phila., 1868, p. 340, *et seq.*
† 2d Series, July, 1869, p. 25, *et seq.*
‡ Vol. v, 1873, p. 334.
§ Am. Jour. Sci. (2), Vol. xlix, p. 235.
‖ Jour. Cincinnati Soc. Nat. His., Oct., 1879, p 2.
¶ Die Kalkbrüche von Mjatschkowà, p. 119, Moskau, 1879.

1881. Wachsmuth and Springer* mention a gasteropod generally covering the anal aperture of *Pterotocrinus depressus*.

1883. Julien Fraipont,† in his Recherches sur les Crinoïdes du Famennien de Belgique, mentions a *Capulus* affixed to a specimen of *Melocrinus globosus* Dew., and in such a position as to indicate that the Capulus did not form the food of the crinoid.

1885. Hinde,‡ describing a new species of crinoids with articulating spines, remarks that three out of eleven specimens discovered of *Hystricrinus carpenteri* (= *Arthroacantha punctobranchiata* Williams) have a *Platyceras* resting on the vault, which it nearly entirely covers ; and there is no doubt that the gasteropod derived its support from the materials rejected by the crinoid.

1888. Keyes,§ in the American Journal of Science, gives a brief summary of the sedentary habits of *Platyceras*, and mentions six species of crinoids having gasteropods attached.

II. Description of Specimens.

It has been intimated elsewhere that the direct paleontological evidence of the sedentary habits of the mollusca belonging to the genus *Platyceras* is found chiefly in the attachment of gasteropod shells to the calyces of certain species of palæozoic crinoids. The diverse structural differentiation of the crinoidal vault and the well-defined surface ornamentation in the various genera, presents, in those species in which the association of the univalves has been observed, determinate features for an adequate consideration of the variability in the apertural margin of the calyptræan shell. Numerous illustrative examples of the following species of crinoids have been examined :‖ *Ollacrinus tuberosus* Lyon and Casseday, *O. typus* Hall, *Actinocrinus verrucosus* Hall, *Physetocrinus ventricosus* Hall, *Strotocrinus regalis* Hall, *Dorycrinus immaturus*¶ Wachsmuth and Springer, *Marsupiocrinus cælatus* Phillips, *Eucladocrinus millebrachiatus* Wachsmuth and Springer, *Platycrinus hemisphæricus* Meek and Worthen, *Arthroacantha punctobrachiata* Williams, *Pterotocrinus acutus* Wetherby, and *Cromyocrinus simplex* Trautschold.

In *Ollacrinus* the vault is comparatively large, nearly flat, with the anal opening eccentric, and the plates are more or less convex or nodose. In some specimens of *O. tuberosus* L. & C. from the Keokuk of Crawfordsville, Indiana, this nodosity of the ventral plates reaches a high devel-

* Revision Palæocrinoidea, pt. ii, p. 90, 1881.

† Annals Soc. géol. de Belg., t. x, Mémoires, 1883, p. 62.

‡ Annals and Mag. Nat. His., March, 1885, p. 172.

§ Am. Jour. Sci. (3), Vol. xxxvi, p. 269, 1888.

‖ The observations herein noted are based principally upon numerous exemplifications in the extensive and unrivaled series of paleozoic crinoids in the collection of Messrs. Wachsmuth and Springer, to whom sincere thanks are tendered for free access to their cabinets.

¶ It may be stated that this species has been figured and described in the eighth volume of the Illinois Geological Survey, now in press.

opment. The nodes of certain plates are much more pronounced than others, and are more or less confluent, forming a conspicuous stellate figure, the points of which are directed interradially. More than one-half of the Crawfordsville specimens of this species have resting on the vault a *Platyceras*—usually *P. æquilaterum* Hall. The specimens illustrate well the adaptation of the apertural margin of the shell to the irregularities of the crinoidal surface, for it is clearly observable, as was first pointed out by Meek and Worthen, that the contact of the gasteropod shell and crinoid is not the result of accidental pressure, but that the mollusk adhered to the surface of the crinoid for a considerable period, as is shown by the sinuosities of the peristome corresponding exactly to the inequalities of the surface beneath. In young shells the sinuosities of the apertural margin are comparatively much more pronounced than in older individuals. Many of the latter exhibit much irregularity in the lines of growth, which might at first appear to be due to a change of situation, but closer inspection shows that this is not the case. When the plates of the vault are nodose, as in *Ollacrinus tuberosus,* the lines of growth in old shells, contrary to the more usual manner among gasteropoda generally, are far from being even approximately parallel to one another; and in the margin of the shell a sinus caused by a nodose plate at one period of growth may be represented in the next by a projecting lobe which had extended into a deep depression between the nodes of two contiguous plates. From an examination of the impressions made by the calyptræan shell on the vaults of *Strotocrinus* and some other genera, it appears that the anterior end of the *Platyceras* is always stationary at the margin of the anal opening, and that as the growth of the shell continues the posterior portion is removed farther and farther from the ventral aperture in the crinoid. *Platyceras æquilaterum,* when stationed on the flat vault of *Ollacrinus,* has the spire much more depressed, and the aperture comparatively much larger than is usual with this species. This fact is also in accordance with observations among the living representatives of a closely allied genus, *Capulus,* in which it has been found that individuals attached to flat surfaces have the shells much more depressed than those that have settled on convex bodies. If *Platyceras æquilaterum* was entirely sedentary in its habits, as there is reason to believe, it would seem, from the diverse forms, that its habitat comprised a variety of objects other than crinoids. Indeed the shell of this gasteropod is extremely variable in form, some specimens being nearly hemispherical with a small spire subcentrally located, while others are nearly flat and the spire projects far beyond the posterior margin of the aperture. Of the many examples of crinoids with attached *Platycerata* only two instances have been noted in which these gasteropods are associated with *Actinocrinus,* or other genera having a prolonged anal tube—the so-called "proboscis." Meek and Worthen* knew not a single case of this kind, and state that it is "probably due to the fact that in species with a 'proboscis' there is much less

* Geol. Ill., Vol. v, p. 335.

room for attachment to the vault." If the gasteropods of this genus subsisted upon the excrementitious matter from the crinoid the reason is obvious for their non-occurrence on species having a prolonged anal tube. In one of the cases referred to the *Platyceras* was just visible between two of the arms of the crinoid, but the matrix was too compact to permit of removal, and in the other, *A. verrucosus* Hall, the molluscan shell was at the base of the anal tube, which, however, appeared to have been injured. It is very probable that on account of this deformity there was an additional opening at its base.

But few illustrative instances are furnished by *Physetocrinus*. In *P. ventricosus* Hall the dome is low, hemispherical, but the univalve associated is remarkable for its comparatively large size, covering nearly the entire vault. *Strotocrinus* presents numerous interesting examples. *S. regalis* Hall, from the Burlington limestone, has the vault relatively very large and flat as in *Ollacrinus*, but the dome plates are small and nearly plane. Like in the *Ollacrinus* from Crawfordsville, Ind., the undetermined *Platyceras* found on this crinoid is very much depressed, the aperture ample and nearly circular in outline. In several specimens the univalve has been carefully removed, revealing a series of concentric impressions which, as has been previously stated, mark the different stages in the growth of the shell. Perhaps one of the most notable examples is an undescribed *Dorycrinus** from the Kinderhook of Marshall county, Iowa. In this species the dome is convex with broad radial elevations which become more pronounced toward the arm bases. On the posterior side of the calyx there is a prominent ridge, at the top of which is situated the anal opening, just below the central dome plate—the latter being rather large and produced into a high conspicuous node. The arms are twenty in number, equally divided among the rays, and equidistant from each other, forming a close, almost continuous circle around the periphery of the vault. The associated *Platyceras* is of the *P. infundibulum* type, but instead of being attached laterally between the two posterior arms—as in the case of the Crawfordsville species of *Platycrinus*—it is stationed directly on the vault, with the anterior portion of the shell over the anal opening. In this position the mollusk has its anterior extremity directed toward the posterior side of the crinoid, instead of the usual opposite direction; it also covers the subspinous process of the central plate, and the apertural margin reaches to the arm bases on all sides except the two postero-lateral. When thus covering nearly the entire vault the depressed interradial areas give to the aperture of the shell a marked quinquelobate appearance.

The Platycrinidæ present both numerically and structurally the finest series of illustrative examples, but they are unequally distributed among three genera: *Marsupiocrinus, Eucladocrinus* and *Platycrinus*—the typical genus furnishing the large majority of the specimens. In *Marsupiocrinus*

*This *Dorycrinus* has been defined by Wachsmuth and Springer, in the eighth volume of the Illinois Geological Survey, now in press.

cælatus Phillips, from the Upper Silurian of Dudley, England, the vault is composed of a large number of small plates, and the anus is subcentral. In *Platycrinus* and *Eucladocrinus* the vault is more or less hemispherical with the simple anal aperture lateral in position. *Platycrinus hemisphæricus* M. and W. is a common species in the Keokuk shales of Crawfordsville, Indiana, and like *Ollacrinus* from the same locality a large proportion of the specimens have attached *Platycerata*—usually *P. infundibulum* M. and W., though not unfrequently *P. æquilaterum* Hall is also found associated with this *Platycrinus*. The former is a straight, elongate-conical shell with numerous longitudinal plications ; while the latter is a more or less depressed, subspiral form, with a very large aperture. The attachment of these gasteropods to *Platycrinus* is somewhat different from that of the other genera mentioned, being at the side between the arms, instead of on the vault. As the growing shell increased in size it encompassed the bases of two postero lateral arms, and in some cases the posterior portions of the univalve even extended to and enclosed the stem of the crinoid. *Eucladocrinus*, from the Burlington limestone, presents the same general features as *Platycrinus* in the attachment of *Platycerata ;* and it is worthy of note that this gasteropod from the Burlington is remarkably similar to *P. infundibulum* from the Keokuk. In *Arthroacantha, Platyceras erectum* Hall is found on the vault. Hinde* mentions two species of *Platyceras* associated with this crinoid, *P. erectum* Hall and *P. dumosum* Conrad. In *Pterotocrinus* the vault is entirely different from those of the other genera here mentioned. It is much elevated, being two or three times as high as the dorsal cup. The first radial dome plates are produced into monstrous alate processes, leaving a small summit which is perforated for the anus. The anal opening is usually covered by a very small *Platyceras*. In a number of examples the summit of this crinoid became too small for this little gasteropod, and the margin of the growing shell has followed closely the depressions between the radial dome plates, which have given rise to large deep sinuosities in the apertural margin.

Cromyocrinus simplex Trauts., from the subcarboniferous of Russia, supports a broad subspiral *Platyceras* described as *Capulus parasiticus* Trauts. Trautschold† in describing the crinoid calls attention to a cylindrical process lying above the anal plate, and to a gasteropod frequently found attached to this region of the calyx, he then adds : "Es ist nicht unmöglich, dass der oben beschriebene cylindrische Processus der Analplatten zum Schutz gegen diese Verfolger des *Cr. simplex* aufgebaut ist." The "cylindrical process" here referred to is manifestly a ventral sac, and both its structural and functional character were entirely misunderstood.

The occurrence of *Platycerata* attached to some other species of crinoids has been noticed, but opportunity for personal examination has not been offered. Yandell‡ mentions that gasteropods are sometimes enclosed in

* Ann. and Mag. Nat. Hist., March, 1885, p. 172.
† Die Kalkbrüche von Mjatschkowa, p. 119.
‡ Proc. A. A. A. S., 1851, p. 234.

the arms of *Glyptocrinus decadactylus* Hall. This writer in his description* of *Acrocrinus shumardi* also calls attention to a *Capulus* on the vault of that species as clearly proving the carnivorous habits of the crinoideans. *Melocrinus globosus* Dewalque, with a *Platyceras* adhering, has been found in the schistes de Frasnes à Senzeille by Fraipont,† who says: "Cette position du mollusque sur de crinoïde vient apporter une preuve de plus contre l'opinion des paléontologues qui soutiennent que les *Capulus* rencontrés sur ces crinoïdes servaient de nourriture à ceux-ce." Finally, Meek and Worthen‡ mention a *Platyceras* adhering to the side of a *Pentremites godoni* "so as to cover one of the pseudo-ambulacral fields and two intermediate areas"

III. Summary.

When attention was first directed to fossil crinoids having *Platycerata* attached, conclusive proof of their carnivorous habits was thought to be established, and inasmuch as it was then considered that the aperture in the vault was the mouth, this explanation for a long time appeared very plausible. Consequently the conclusion was very naturally reached, that the crinoid when it perished was in the act of devouring the mollusk. Meek and Worthen§ seem to have been the first to demonstrate that the prevalent opinions regarding the intimate association of crinoid and *Platyceras* were erroneous, and that the gasteropod was undoubtedly stationed on the crinoid for a protracted period, and very probably even for the greater portion of its life. But notwithstanding the fact that the univalve was almost invariably situated over the ventral aperture, and that this opening was recognized as the anus, these writers do not appear to have entertained for a moment the idea that the gasteropod may have been nourished on the refuse matter from the crinoid. The latter view was more recently advanced by Wachsmuth, and has since been favorably received by other paleontologists. In all of the specimens lately examined—probably upwards of one hundred and fifty—the *Platyceras* covers the anal opening of the crinoid, and as far as observable, it is always the anterior portion of the molluscan shell that is directed towards the vault aperture. In those examples in which the shell has been removed, its impression made on the ventral surface shows that the anterior margin of the peristome was at the edge of the opening in the dome—a position that would have brought the mouth of the mollusk directly over the anal aperture of the crinoid. The food of recent crinoids consists chiefly of animalcules and microscopic plants, and the living Calyptræidæ subsist on food of a similar nature. From analogy it might be inferred that the food of the fossil crinoids and mollusks must have been like that of their recent representatives. So far as these echinoderms are concerned, there appears

* Am. Jour. Sci., (2), Vol. xx, p. 135.
† Annal Soc. géol. de Belgique, t. x, Mémoires, 1883, p. 62.
‡ Geol. Ill., Vol. iii, p. 386.
§ Proc. Acad. Nat. Sci. Phila., 1868, p. 340, *et seq.*

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to be no serious objections to this inference; but with the univalves their position through life indicates that their food was in great part at least of an entirely different nature, and this is one of the considerations that suggest a possibly much wider generic separation of *Platyceras* and *Capulus* than is apparent from a comparison of the shells. The anatomy of the crinoid and the position of the molluscan shell are opposed to the supposition that the gasteropod may in any way have been nourished on the food of the crinoid. This would imply that the mollusk was parasitic in its habits, a view which, though held by some writers, does not appear to be structurally sustained. While no doubt the *Platyceras* derived the greater portion of its food from excrementitious matter, nourishment from other sources may also have been obtained, and in all probability it was very similar to that of the crinoids and living Calyptræidæ. Furthermore there does not seem to be the slightest indication that the crinoid was in any manner inconvenienced by the attachment of the gasteropod, except perhaps in a few cases where the molluscan shell has encircled the postero-lateral arms which were in consequence slightly pressed outward. The only really noticeable effect of the presence of *Platyceras* on the crinoid is a comparatively shallow depression or groove on some of the vault plates—marking the position of the shell margin; yet in the majority of specimens this feature is scarcely perceptible.

In considering the structural peculiarities of the *Platyceras* shell three features—the general form, the configuration of the aperture, and the surface markings—appear to have been susceptible of considerable modification as the result of the sedentary habits of the mollusk. An examination of a large series of certain species of *Platyceras* reveals that the variant tendency in all three of these particulars is much greater than might be supposed, but when the attachment of these gasteropods to foreign bodies is taken into consideration the causes for such varietal development become manifest. It has been shown that the mollusk doubtless remained fixed throughout a greater portion of life, and that the surface upon which it first settled determined in great part both the form of the shell and the shape of its aperture. When the surface of attachment was flat, as in the vaults of *Ollacrinus* and *Strotocrinus*, the shell was greatly depressed and the peristome ample, but when the foreign body was strongly convex the shell was more conical with a comparatively much smaller aperture. It has been shown elsewhere that, in regard to the second of the three variant features observable in the calyptræan shell, the margin of the peristome partakes of all the inequalities of the surface to which the gasteropod adheres. Few of the species attached to crinoids may be said to have true surface ornamentation, but the longitudinal folds or plications in the shell are in many cases due largely to the character of the surface of attachment. In some specimens of *Platyceras infundibulum* M. and W. there has been observed in addition to the undefined longitudinal folds, series of small conspicuous nodes; but in all examples these nodes appear to have resulted from the peculiar nodose ornamentation of *Platycrinus hemisphæricus* with which these univalves were associated.

Recapitulating the salient features relative to *Platyceras* as here presented, it appears : (1) that many. if not all, of the *Platycerata* were stationary during life ; (2) that the nourishment of these gasteropods was derived in great part at least from the excrementitious matter of the crinoid ; and (3) that the form of the peristome and its marginal configuration, being dependent upon the surface of attachment, have small value as characters for specific distinction. The first and third of these propositions are consonant with observations made upon living Calyptræidæ, while the second does not seem to present in this group any living analogue, and this fact is indicative of perhaps a wider separation generically of *Platyceras* and *Cupulus* than has hitherto been considered.

The species of *Platyceras* in which sedentary habits are positively known from the attachment of the gasteropods to foreign bodies, are :

Platyceras æquilaterum Hall, *P. infundibulum* M. and W.
P. parasiticum (Trautschold), *P. chesterense* M. and W.
P. erectum Hall, *P. dumosum* Conrad,
P. formosum Keyes, and five undetermined species.

IV. Descriptions of Four New Species of Platyceras from the Lower Subcarboniferous of Iowa.

Platyceras capax, nov. sp. (Plate, figs. 14 and 15).

Shell below medium size, ovate, subspiral, forming scarcely one volution, rapidly and regularly expanding, both transversely and in the opposite direction, to the aperture. Apex small, obtuse, free, but more or less incurved toward the body of the shell, which is strongly arcuate ; very slightly deflected dextrally. Aperture nearly circular in outline, margin attenuated, and but slightly sinuous. Surface marked by distinct often somewhat imbricated lines of growth.

Horizon and locality. Burlington limestone near Burlington, Iowa.

This species approaches, nearer than any other, some forms of *P. æquilaterum* of Hall from the Keokuk limestone, but differs in having the body of the shell more arcuate and in uniformly expanding much more rapidly in the direction of the longitudinal diameter of the aperture. The apex is also farther removed from the body of the shell than in the Keokuk species, and there is no indication of longitudinal folds.

Platyceras obliquum, nov. sp. (Plate, figs. 12 and 13).

Shell of medium size, irregularly oblong, subspiral, forming one volution, regularly enlarging, slightly more rapidly transversely than in the opposite direction, to the aperture. Apex large, obtuse, far removed from the body of the shell, which is broadly arched ; very noticeably oblique to the plane of general curvature in the body of the shell. Aperture irregularly quadrangular in outline ; lip sharp, and more or less sinuous. Surface marked by several undefined longitudinal plications, which sometimes form longitudinal series of obscure nodes ; these are crossed by numerous sinuous often subimbricated lines of growth.

Horizon and locality. Limestones of the Upper Burlington at Burlington, Iowa.

Platyceras latum, sp. nov. (Plate, figs. 10 and 11).

Shell large, depressed, forming about one and one-half volutions, very rapidly expanding from the apex to the aperture, but enlarging transversely much more than in the opposite direction; posterior side comparatively very short. Apex small, incurved, but free from the body of the shell, and nearly in the same plane as the general curvature. Aperture very large, campanulate, transversely elliptic; lip attenuated and slightly sinuous. Surface marked toward the aperture by a few small nearly obsolete folds, and by numerous sinuous lines of growth.

Horizon and locality. Burlington limestone at Burlington, Iowa.

Platyceras formosum, nov. sp. (Plate, figs. 8 and 9).

Shell curved, slightly oblique, enlarging rather rapidly to the ample irregularly pentalobate aperture, posterior side rather short and concave, lateral slopes nearly straight. Apex apparently obtuse. Aperture rather large, somewhat pentalobate. Surface marked by five broad well-defined longitudinal plications, each of which are composed of several smaller folds; these are crossed by sinuous lines of growth.

Horizon and locality. Kinderhook beds of Marshall county, Iowa.

The two specimens of this species found are both attached to the vaults of specimens of a *Dorycrinus* which has been described in the forthcoming volume of the Illinois Geological Survey now in press.

EXPLANATION OF PLATE.

Fig. 1.—Dorsal view of *Platycrinus hemisphæricus* M. and W. with *Platyceras infundibulum* M. and W. attached to anal side.

Fig. 2.—Lateral view of *Platycrinus hemisphæricus* M. and W. with *Platyceras equilaterum* Hall attached to the anal side, partly enclosing the postero-lateral arms and the stem.

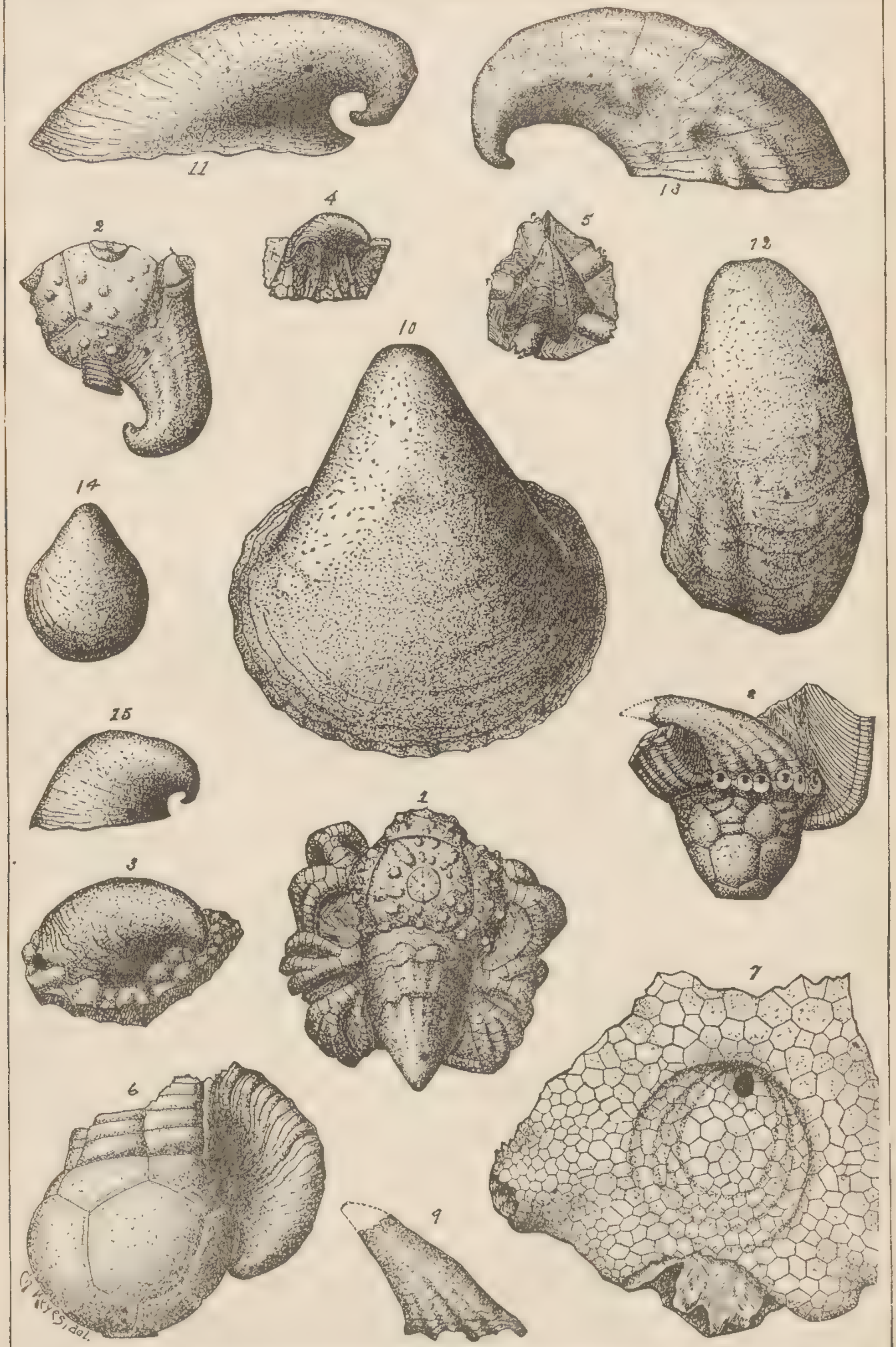
Fig. 3.—Portion of the vault (viewed obliquely) of *Ollacrinus tuberosus* Lyon and Casseday with *Platyceras equilaterum* Hall covering the anal aperture.

Fig. 4.—Portion of the vault of *Pterotocrinus acutus* Wetherby with *Platyceras chesterense* M. and W. attached and covering the anal opening. *r*, *r*, the fractured surfaces of the monstrous alate radial dome plates.

Fig. 5.—Portion of the vault (viewed from above) of *Pterotocrinus acutus* Weth. with *Platyceras chesterense* attached; another specimen showing the five prominent folds in the gasteropod shell. *r*, *r*, the radial dome plates.

Fig. 6.—Lateral view of *Cromyocrinus simplex* Trautschold with *Platyceras parasiticum* (Trauts.) attached to the anal side. From the Subcarboniferous of Russia.

Fig. 7.—Portion of the vault of *Strotocrinus regalis* Hall with the *Platyceras* removed, showing the anal aperture of the crinoid and the concentric impressions made by the lip of the gasteropod shell at different periods, which mark the growth of the shell.



Keyes on Platyceras.

Fig. 8.—*Dorycrinus* (species undescribed) with *Platyceras formosum* Keyes attached.

Fig. 9.—Another view of *Platyceras formosum* Keyes from the Kinderhook of Marshall county, Iowa.

Figs. 10 and 11.—*Platyceras latum* Keyes from the Burlington limestone.

Figs. 12 and 13.— *Platyceras obliquum* Keyes from the Burlington limestone.

Figs. 14 and 15.—*Platyceras capax* Keyes from the Burlington limestone.

Figures 1 to 9 are from specimens in the collection of Messrs. Wachsmuth and Springer; figures 10 to 15 from specimens in the collection of the writer.

The Funeral Customs of Ireland.

By James Mooney (Washington, D. C.).

(*Read before the American Philosophical Society, October 19, 1888.*)

SYNOPSIS. I. Ancient.

Primitiv Ideas of Spirit World.—Tying the ghost—driving off ghosts—offerings at grave—heaven and hell—purgatory and transmigration—leads to embalming, etc.—modern ideas developd from the old, as shown by archæology and survivals.

Early Races of Ireland.—Fomorians—Firbolgs—Tuatha-de-Dananns—Milesians—the first probably not Aryan.

Ancient Burial Types.—Disjointed burial—extended burial—cremation—mounds, kistvæns and urns—cremation nearly universal—Australian and other parallels of disjointed burial—generally indicates lowest status of savagery—extended burial may be Danish—examples—cremation—New Grange, etc.—urn burial—body sometimes cremated within the tomb—battle of Moytura and burial notices—funeral sacrifices and cannibalism—the round towers, not sepulchral—royal burial and Indian parallel—brain balls as trophies—legend of King Conor MacNessa.

II. Modern.

Causes of decay of old customs—Omens—the Banshee—fairy influence in sickness and death—instances—feeding abducted persons—fairy changelings—malignant spirits—feathers at death—burying the disease, parallels. Preliminaries—hoarding for the funeral—ceremonies of the dying bed—laying out the corpse—the Máistínid'—watching the corpse. The Wake—origin and purpose—the gathering—the Caoine or funeral lament—

English specimen—Gaelic Caoine. WAKE GAMES—former dramatic games described by authors—Broigín—Cloif air Bas—Broigín or Haire-haire—Fag'ailt Ceird—Cleas a tsoipín—Ceannac't a G-caora—Sagart a P'arraiste—Dam'sa na G-coinnínid'—Gleus Loinge—marrying games—other games from Carleton. THE FUNERAL—leaving the house—carrying the corpse—beliefs—the lament—curious custom and legend—garlands—circuits about crosses—murder funeral in the north—Fairead''n Team-poll—Kilranelagh churchyard and child burial—churchyard ceremonies and beliefs—digging the grave and legend—family burial and beliefs—Kerry legend—sacred cemeteries—Templeshambo cemetery, for men and women—funeral cures and charms—the murder test—the Feur Gortac'—CARNS OR LEAC'TA—history of a Kerry leac'ta—leac'tas at Cong. THE FUTURE LIFE—transmigration, butterflies, seals—dying in debt—salt and wool—visiting ghosts—hallow eve—meeting a ghost—transmigration of inanimate objects and instances.

As all religions are based upon the belief in a future life, so the funeral customs of a people, as embodying their conception of the nature of this future life and the necessary preparation for entering upon it, furnish the surest index of the character of the popular religion.

In the lower stages of fetichism, where all the ideas of a future life ar vague and unformd, no special abiding place is assignd to the disembodied spirit, which is supposed to hover unseen about its accustomd haunts, to the sore annoyance of its former friends among the living. Hence the funeral ceremonies ar intended rather to get rid of the troublesome ghost of the deceased than to provide for his comfort in the next world or to perpetuate his memory in this. For this purpose the Fijians and Australians tied the feet of the corpse that the ghost might not be able to rise out of the grave,* other savages returned by a roundabout way from the grave to the village so that the spirit might be unable to find the road back, while stil others compeld the widow to bathe in the river immediately after the burial of her husband, in order to "wash off the ghost," or perhaps rather to throw it off the scent. This probably explains also the Indian custom of changing the name upon the death of a near friend† and the universal unwillingness of savages to pronounce the name of the dead, a dislike which some tribes carry to such an extreme as even to discontinue the use of any words which might suggest the unseen presence.

As fetichism took on a higher development the floating ideas of the

*Lorimer Fison, Fijian Burial Customs, in Jour. Anth. Inst., x, London, 1881; A. W. Howitt, On Some Australian Beliefs, Jour. Anth. Inst., xiii, 190, London, 1884.

†This custom existed among the tribes on Albemarle sound in 1585 (Hariot, in Hawke Hist., N. C., i, 1859), and was found nearly three centuries later among the Chinooks on the Pacific coast (Swan, Northwest Coast, 189, New York, 1857).

earlier stages wer combined into a mythologic system in which the spirit world was localized and the future life became a shadowy counterpart of this, with the same passions, pleasures, pursuits and necessities. Accordingly the soul about to set out for the land of the dead must be provided with food during the journey—which among the northern Indian tribes was generally supposed to occupy four days—with weapons of war and the chase, with cups, dishes and other utensils, with dresses, beads and rings for personal adornment, with horses to ride and slaves to do its bidding. A remarkable survival of this idea among the colord people of Washington is exemplified at Graceland cemetery, where the graves of children ar coverd with the toys prized by their owners in life, from dolls and sets of toy dishes down to whips, balls and old oyster cans. The animism of the savage recognized the existence of a spirit in every object about him, from rocks, trees and animals down to the commonest articles of every day use. He knew that in death, altho the body remaind behind, an invisible enlivening something was gon, and according to his philosophy this *anima* escaped from the mouth with the last breath of the dying man or past out from the gaping wound with his life blood. When the pot was broken, altho the fragments might be joined together again, the clear, musical ring was gon—the *anima* had escaped and the pot was dead. Reasoning from these premises he shattered the bowls, tore the garments and slaughterd the dogs, horses and slaves about the tomb in order that their imprisond spirits might be releasd the more quickly to follow their master to the land of shades.

When a man's importance grew to be directly commensurate with the extent of his possessions in goods, horses or slaves, the same principle was held to apply to the next world, and it became a matter of duty and pride with the survivors to contribute to the dignity of the dead chief by adding to the number of the funeral offerings and swelling the train of victims, until, as in the case of a Dahoman or a Zulu king, we find whole armies butcherd that their shades may accompany the dead tyrant to the spirit land. The duty of the slave became the privilege of the nearest friend of the deceasd, and led the Natches Sun and the Hindu Suttee alike to sacrifice themselves over the corpse of the loved one that their spirits might be united in the other life.

In the primitiv community a man's acts wer good or bad only as they affected the welfare of the tribe at large, and any wrong-doer met swift punishment at the hands of the aggrievd individual or clan. With the development of civilization came the idea of abstract morality or virtue, and the establishment of a code of morals whose infraction might merit punishment not only here but also hereafter. This involvd exclusion from the abode of the happier shades, but as the idea of a hel was of slow growth, the natural result was the doctrin of metempsychosis, the most common form of which belief held that the soul passd a probationary period as the unwilling tenant of the body of some animal—a horse, a dog, a wolf or even a worm—suffering all the animal vicissitudes while

retaining its human and spiritual nature, and transferd from the body of one animal to that of another, by a series of changes varying in number and character according to the degree of punishment merited, until, purified by suffering, it was allowd to return once more to its original human body and enter with it into happiness.

It was an essential point of this doctrin that the body must be preservd from decay, or rather from dissolution into the elements, otherwise the soul, unable to enter again into its earthly tabernacle, would be compeld to return to its animal prison or become a lonely wanderer through all eternity. Hence the pains taken among early nations, by embalming or by the erection of huge funeral mounds, to prevent the destruction of the body or the scattering of its ashes. A similar idea seems to underlie the belief that a failure to perform the customary funeral rites doomd the soul to wander in outer darkness. This belief seems to hav been general among the northern Indians, as evinced by the desperate efforts they invariably made to bring off their dead from the field of battle, by their anxiety to "cover the bones" of their murderd friends, and by the Iroquois custom of driving away the ghost of a tortured prisoner with shouts and hideous noises after the blackend and mutilated corpse had been thrown out from the village to lie unburied in the forest.* It was evidently held also by the ancient Irish, as is shown by some of their old popular tales.

The Early Races.

As the human mind, under ordinary circumstances, develops by regular stages, so there is a regular sequence in the beliefs and customs which mark this development. The most highly civilized nations of to-day hav risen through all the intermediate grades from savagery, and in studying their national life we shal find lingering remains of customs which can be explaind only through a knowledge of the existing beliefs of more primitiv peoples, and if we can pursue the investigation into the domain of archæology we must expect to meet evidences of former practices which ar now relegated to the lowest savages. In treating of the funeral customs of Ireland, a country especially rich in the remains of antiquity, it is necessary to a proper understanding of the subject to go back to the earliest period of which we hav any monuments. It is not, however, practicable within the limits of this paper to enter into a detailed account of particular structures or to institute a comparison with similar works on the continent.

The Irish, like every other historic nation, ar a mixt race, and the native annals, which unquestionably go back to a remote antiquity, recount several invasions or colonizations of the island long before the Christian era. The aborigines of the country, or, more correctly speaking, the earliest colonists, wer known as Fomorians, which, however, was not their true name, but that imposed by their conquerors. They ar said to hav come

* Greenhalgh (1677), in Doc. Hist., New York, i, 16.

originally from Africa. Then we hav accounts of successiv colonies which made no permanent impression until the landing of the Firbolgs (pronounced *Firbullag*), supposed to hav taken place about seven hundred years before Christ. The Firbolgs conquerd the country, establishd a regular form of government and drove the aborigines before them until the remnant took refuge on the islands which skirt the western coast, where they earnd the name of Formorians or Pirates (Gaelic, *Fomoraigh*) by their forays upon the settlements of the invaders upon the mainland. About one hundred and seventy years later another people, the Tuatha-de-Dananns (pronounced *Thua-dhĕ-Dhan-yawn*), landed upon the eastern coast and demanded a portion of the island. This demand being refused, the invaders advanced rapidly into the interior while the Firbolgs retired before them until the latter, having apparently been joined by the Fomorians, concentrated all their forces on the plain of Moytura, on the southern border of the County Mayo. Here about five hundred and thirty years before Christ, took place the most celebrated battle in the ancient annals of Ireland, the struggle lasting four days and resulting in the total defeat of the Firbolgs and the death of their king. The magnitude of the conflict is attested by the number of sepulchral mounds and monumental pillar stones extending for miles and giving to the plain the appearance of one vast cemetery, as it is in fact the grave of the Firbolg nation. The survivors wer allowd to remain in the western province of Connaught and the adjacent islands, where the remnant of the Fomorians stil existed. Here they wer joind by their kindred from all parts of the island, while the conquerors took possession of the other portions of the country.*

Stil later the Milesian invaders, from whom the ruling families of Ireland traced their descent, obtaind control of the island, but they seem to hav differd from the Tuatha-de-Dananns chiefly in the degree of their civilization. It is notable that all of these invasions ar said to hav come from the continent, instead of from the adjacent island of Britain.

Here we hav the names of three distinct peoples successivly ruling in Ireland—the aboriginal Fomorians, the Firbolgs and the Tuatha de-Dananns—and the question arises, Who wer they? As Gaelic is a Keltic language we may assume that the Tuatha-de-Dananns, who left the final impress upon the country, wer a Keltic race; but with regard to the others it seems equally certain that one at least was not Keltic, if indeed it belongd to the Aryan stock at all. In the manuscript Book of Mac Firbis, written about 1650, we ar told that "every one who is black, loquacious, lying, tale-telling or of low and groveling mind, is of the Firbolg descent," while "every one who is fair-haired, of large size, fond of music and horse riding, and practices the art of magic, is of Tuatha De Danaan

* The original MS. account of the *Cat'Mag'Tuiread'* or Battle of Moytura is preserved in the library of Trinity College in Dublin, besides which there ar two or three copies. An excellent summary of this account, with an identification of the locations, is given by Sir Wm. Wilde, Lough Corrib., Dublin, 1867.

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descent."* These two distinct types—one large-bodied and blond, the other darker and generally more slender—exist in Ireland to day, and the difference has been noted by every observant traveler. The blond race is most numerous east of the Shannon, the portion occupied by the Tuatha-de-Dananns, while the darker race is found chiefly along the west coast, to which the old Fomorians and Firbolgs retired when their power was broken. The inroads of the Danes and later invaders ar not sufficient to account for this difference. The testimony of most ancient writers goes to show that the Kelts wer of the blond type, but the Firbolgs ar expressly described as a dark race, inferior in intellect to their conquerors, the Tuatha-de-Dananns. Nothing is said of the physical type or mental status of the Fomorians, but the indications ar that they wer but little removed from savagery. If the Firbolgs wer Kelts they cannot hav differd greatly from the Tuatha-de-Dananns, and it is possible that the Mac Firbis confounded under one name the Firbolgs and the earlier Fomorians, who wer both driven to take refuge along the western coast, where they became allies against the common enemy. At all events we hav evidence of the former existence in Ireland of a pre-Keltic dark race, physically and intellectually different from the conquering race, and there is good ground for the opinion that either the Firbolgs or the Fomorians wer a part of that ancient people who preceded the Kelts in western Europe, and who, under the various names of Silures, Iberians and perhaps Ligurians, hav left traces of their former presence in Britain, France, Spain and Italy, but whose limits hav been contracted by centuries of conquest and absorption, until their modern descendants, the Basques, ar now confined to the valleys of the Pyrenees. How far this hypothesis may be true must be left for the philologist and archæologist to decide by a critical study of the language and antiquities of Ireland, and their comparison with the prehistoric languages and antiquities of the continent.

Disposition of the Body—Grave Types.

In studying the funeral remains of ancient Ireland we find the body disposed of in three distinct ways, by disjointed burial, by extended burial and by cremation, the last method being by far the most common. The process of embalming or mummy burial seems to hav been unknown as well as the contracted burial, so frequent in English mounds and probably belonging to the early Saxon period. The burial structures may also be divided into three classes, the mound, the subterranean kistvaen and the simple urn. The character of the structure, however, is no indication of the condition of the human remains, as the mound may cover either

*Quoted from Eugene O'Curry's translation, by Sir Wm. Wilde, The Boyne and the Blackwater, 2d ed., Dublin, 1850, 218 and 221. The rendering is somewhat different in O'Curry's Lectures on the Manuscript Materials of Ancient Irish History (reissue, 223–4, Dublin, 1878), and the detailed description there given of the descendants of the Firbolgs shows that they wer held in utter contempt by the later races. The fact that magic powers ar attributed to the Tuatha-de-Dananns probably indicates their superiority to the earlier races in the arts and in general knowledge.

a skeleton or a cinerary urn, while in many cases the skeleton and the cremated remains ar found together.* The two methods of disjointed and extended burial belong either to two distinct races or to widely separated periods, while cremation appears to hav been practiced at all times and by different races. As Fomorians, Firbolgs and Tuatha-de-Dananns each in turn held sway over the whole island until restricted and hemd in by a late invasion, it follows that we may expect to find the remains of any one people most numerous where their dominion was earliest establishd or where they held out longest against their conquerors. An archæologic map of Ireland, which should indicate the character and number of the prehistoric remains in each district of the country, would be invaluable in this connection, but without this we ar obliged to depend upon descriptions of isolated monuments, and it is therefore impossible to mark out race areas.

As cremation cannot be assignd to any particular period, we shal speak first of disjointed burial, which evidently belongs to a very ancient and distinct race type. According to Wilde, the disjointed skeleton is usually found beneath the surface in "a kistvaen, or small stone chamber, roofed either with a single flag or covered in with that form of arch resembling a beehive dome. There is no tumulus or heap of earth to mark the site of these sepulchres, several of which have been turned up with the plow. Within this small square vault the bones are generally placed in a regular manner, the small ones at the bottom, the long ones, as the legs and arms, at the top, and the whole is crowned with the skull."† In one instance, in the Queen's county, the stone chamber was found in the outer circle of a rath, or prehistoric earth fort, and close beside the skeleton was one of the most beautiful cinerary urns ever found in the country. From the general form and symmetry of some of the skuls found with this mode of interment, Wilde is inclined to think that the owners belongd to one of the highest types of the Indo-European race.

A remarkable mound opend in the County Sligo, one of the last strongholds of the Fomorians and Firbolgs, was found to contain a large kistvaen, within which wer the remains of six human interments. In each case the bones wer piled in the manner described and surmounted by the skul, but the smaller bones wer all half-burnd, while around each pile

* According to Rooke Pennington, such is the case also in England. In an article on the "Relative Ages of Cremation and Contracted Burial in Derbyshire," he says: "In fact, it is the rule to find interments in the two modes in the same barrow." Jour. Anth. Inst., iv, 271, London, 1875.

† W. R. Wilde, The Boyne and the Blackwater, 2d ed., 231, Dublin, 1850. The distinguished author, the late Sir William Wilde, was the master spirit in Irish archæology. To avoid needless repetition it may be here stated that, unless otherwise noted, the following descriptions of the prehistoric sepulchral remains at New Grange, Dowth and elsewhere, ar based mainly upon the statements in the valuable chapter on "The Ethnology of the Ancient Irish" in the work above quoted. The statements there given hav been compared with those of Holden, Kinahan, Lewis and others in the volumes of the Anthropological Institute of Great Britain and Ireland, and such conclusions drawn as seemd warranted by the facts.

was collected a quantity of the bones of birds and small quadrupeds and mollusks.

It is evident that the bones could not hav been arranged in this manner until by some process the skeleton had first been denuded of the flesh. This practice was common to many tribes of America, Africa, Australia, and Polynesia. The body was generally buried until the flesh had had time to decay, when the bones wer taken up and cleand and afterward laid away in a place set apart for that purpose. Some tribes allowd the body to decay on scaffolds above ground, while the Australians first skind the corpse and then cut the flesh from the bones, roasted it over a fire and partook of the cannibal feast.* With the Hurons, Choctaws and other Indian tribes the final disposition of the bones was made the occasion of a solemn feast of the dead,† and when the tribe removed to a new location the bones wer carefully packd up and taken along by the surviving relativs, just as the Chinese returning from America to their nativ land bring with them the bones of their deceasd friends whose bodies hav been temporarily deposited in foreign soil.

We may assume that the people who practiced this method wer earlier and lower in the scale than those who practiced extended burial or simple cremation, as we know from analogy that disjointed burial, as a national custom, is found only among savages. The existence of ossuaries in Paris, Naples, and other large cities on the continent, as wel as the practice of bone exhumation in Ireland, is due to the lack of grave space in the regular cemeteries, while in these ancient Irish interments each disjointed skeleton is commonly isolated in a separate grave. The beautiful pottery sometimes found in the vault is no evidence of a high development, as it is wel known that the rudest tribes frequently excel in this art. The shape of the skul shows, if it shows anything, not the degree of civilization to which the race had attaind, but the degree of which it was capable, while the very method of burial, with the attendant indication of human as wel as animal sacrifice, proves that while this race may hav been of the Aryan stock, it was a race which had as yet made hardly the first step toward civilization.

The examples of entire or extended burial ar rare. The kistvaen in this case is enclosed in a mound and contains one or more skeletons in a recumbent position. A mound of this class in the Phœnix park, Dublin, opend in 1838, containd a stone chamber with two perfect male skeletons and parts of another, with a single bone, apparently that of a dog. Under each skul wer a number of small sea shels, which may hav formd a necklace or an amulet. A small bone fibula, resembling those found in Denmark, and a flint arrow head, wer also found. Within the mound, but

* Albert McDonald, Mode of Preparing the Dead among the Natives of the Upper Mary River, Queensland, Jour. Anth. Inst., ii, 176-9, London, 1873; Edward Palmer, Notes on some Australian Beliefs, Jour. Anth. Inst., xiii, 283, London, 1884. For the method in use among the Choctaws, etc., see Adair, Am. Inds., 183, London, 1775.

† Francis Parkman, The Jesuits in North America, 71-8, Boston, 1867; James Adair, Hist. Am. Inds., 183, London, 1775.

not within the kistvaen, wer found four urns containing incinerated human remains. These wer either a later burial or wer the remains of victims sacrificed to the manes of the heros intombd within the kistvaen.

In 1849 four skeletons wer found near Cushendall, County Antrim. "What adds particular interest to these human remains is, that a small stone celt or hatchet, and two bronze celts, wer found along with them; these weapons enable us to form some conjecture of the *probable* age of the skuls, and also show that the bronze and stone weapons wer used at the same time in this country; but that which fixes the date of the interment of these skeletons was the discovery of two small Saxon silver coins of the early part of the ninth century." *

Several considerations render it probable that the instances of extended burial ar not of Irish, but of Danish origin. The Danish and Scandinavian pirates began their inroads upon the east coast of Ireland in 795, and continued their plundering expeditions for over two centuries until their power was broken by the battle of Clontarf in 1014. During this period they establishd themselves so firmly in the principal seaport towns that Dublin itself became a Danish settlement. The few instances of extended burial ar found chiefly along the east coast, within the area of Danish invasion, while the articles found in the tombs correspond with the contents of Danish sepulchres. The Saxon coins found in the tomb at Cushendall fix the date within the Danish period, at a time when the Danes wer as much dreaded in England as in Ireland. Moreover, we hav the testimony of Mallet that at this period—just before their conversion to Christianity—the Danes and Scandinavians practiced this mode of burial.† The presence of stone implements along with those of bronz has been noted also in the English mounds by Rooke Pennington, who is of the opinion that this may be due to a veneration for the stone instrument as an amulet after it had been superseded in actual use by the metal weapon.‡

We come now to cremation and those large burial mounds which hav their typical example in that of New Grange. As this celebrated tumulus is the largest and most elaborate of its kind in Western Europe, a somewhat extended notice is here in place. It must be stated at the outset that, altho its purpose is undoubtedly sepulchral, there is no proof that human remains hav ever been found within it, but from the account of the first writer who described it in 1699 there is every reason to believ that it had been enterd and despoild long before, probably by the Danes, who had one of their principal settlements at Drogheda, in the immediate vicinity of New Grange. It would be the more likely to suffer at their hands as it was the most conspicuous monument in that region. Indeed, we hav the positiv statement in the Annals that the principal grave

* W. R. Wilde, The Boyne and the Blackwater, 2d ed., 239, Dublin, 1850.

† P. H. Mallet, Northern Antiquities, Bohn's edition, 208–211, London, 1847.

‡ Tumuli and Stone Circles near Castleton, Derbyshire. Jour Anth. Inst., iv, 383, London, 1875. The same idea is advanced by an author noted in Mallet's Northern Antiquities, Bohn's edition, 211, London, 1847.

mounds of Brugh-na-Boinne wer plunderd by the Danes in the year 862. Brugh-na-Boinne was the royal cemetery of the Tuatha-de-Danann kings and their Milesian successors, who held their court at Tara, and stretchd for a mile in width along the north bank of the Boyne from Slane in the County Meath to a point about three miles below. Within or adjoining this area ar more than twenty mounds of various sizes, the largest of which is New Grange, while several others ar but little inferior to it, and the whole surface is honeycombd with sepulchral remains.

The New Grange tumulus has sufferd at the hands of builders and road contractors, but is stil about eighty feet high and covers an area of nearly two acres. It was formerly surrounded by a circle of enormous stones placed about ten yards apart. Some of these stil remain, but the pillar stone which once crownd the summit has disappeard. The body of the mound, under the surface layer of earth, is formd of small stones gatherd in the neighborhood, while the immense stones of the interior passages ar generally different in character from any rock found in the vicinity, and some of them must hav been transported from the Mourne mountains, forty miles distant. The mound is enterd by a passage, running nearly north and south, which is sixty-three feet long and is formd of large upright stones roofd with immense flags, supported partly by the upright stones and partly by masonry on the other side. The height of the passage for about three-fourths of its length is about six feet, when it rises so as to slope gradually into the roof of the central chamber. Some of the stones forming this part of the wall ar ten feet high. The average width of the passage is three feet. This passage, with three offsets running out at right angles from the central chamber, giv the interior the ground plan of a cross. One of these offsets is eight feet deep, nine feet high, and seven feet wide. The central chamber is elliptical and is eighteen feet in its longest diameter from the entrance to the opposit wall. The walls ar formd of large upright stones about ten feet high supporting a dome-shaped roof formd by several courses of somewhat smaller stones, each course projecting beyond that below it until the dome is closed by a single flag at the top. This manner of constructing the dome was common to many early nations, and shows that the builders had not yet discoverd the principle of the arch. The height to the centre of the dome is nineteen and one-half feet. The stones of the interior, as wel as one or two near the entrance, ar coverd with curious carvings, chiefly lozenges, zigzags and volutes, sometimes standing out in relief. A remarkable fact in this connection is that on some of these stones the carving not only covers the exposed portions but also extends over a part of the surface which had been completely conceald from view and out of the reach of a tool until uncoverd within recent times, showing that these stones must hav been carvd before they were placed in position in the mound, and perhaps formd part of some structure stil more ancient. In regard to these stones Miss A. W. Buckland thinks that they "were evidently sculptured before they were placed in their present position, and indeed, indications are not

wanting that some of the blocks are, perhaps, more profusely ornamented at the back which is coverd by the earth, than on the side exposed to view."* In each of the three recesses is an oval stone basin about three feet long. This, Wilde considers "a rude primitive sarcophagus," and sums up his impressions as to the general purpose of the tumulus as follows: "We believe, with most modern investigators into such subjects, that it was a tomb or great sepulchral pyramid, similar in every respect to those now standing by the banks of the Nile."†

The large adjacent mound of Dowth is similar to that of New Grange in structure and general arrangement of the interior, excepting that there is no central chamber, the offsets running out directly from the main passage. Some of the stones ar carvd with wheels and concentric circles resembling those sometimes found on Scandinavian dolmens. There ar also leaf carvings so perfect as almost to be taken at first sight for fossils. Within the inner passage is a stone basin similar to those at New Grange, but much larger. It was found in fragments, the pieces having been scatterd through the passages, probably by the Danes, who plunderd the mound in 862. Mixt with the accumulated rubbish within the passages there hav been found at different times heaps and scatterd fragments of burnd bones, many of which wer human, together with numerous unburnd bones of birds, deer and domestic animals. With these wer also found "glass and amber beads of unique shapes, portions of jet bracelets, a curious stone button or fibula, bone bodkins, copper pins and iron knives and rings."‡ A stone urn has also been found within the passage and another in a kistvaen in the mound.

It is probable that both these mounds wer originally designd to hold the incinerated remains of some of the royal line of the Tuatha-de Dananns, whose ashes may hav rested within the stone basins already mentiond, or perhaps wer placed in urns upon them.

The most common form in connection with cremation is the urn burial, concerning which Wilde says that "the cinerary urn containing the remains of burned human bones has been found not only as a separate and distinct form of burial, but also in connection with the cairn, the cromlech, and the kistvaen or small stone chamber. Moreover, we have instances of bones being found partially or completely burned in some of the larger sepulchres, without any trace of the urn whatsoever."§ In 1842, while working a quarry near Drogheda, a farmer came upon from one hundred to two hundred urns of unbaked clay, of various sizes, nearly all placed in an inverted position and each containing incinerated human bones. They wer placed a few feet apart, without any apparent regularity and without any flag or stones to protect them, so that

* Notes on some Cornish and Irish Prehistoric Monuments, Jour. Anth. Inst.. ix, 152, London, 1880.

† W. R. Wilde, The Boyne and the Blackwater, 2d ed., 201, Dublin, 1850.

‡ Idem, 209.

§ Idem, 232.

most of them had been prest in and broken by the weight of the earth above. One of those examind containd the remains of several individuals, together with bones of birds and some small animal. In another wer found a flint arrow head and a small bone needle.

The urn is also found in connection with the dolmen, as in the mound in Phœnix park, already mentiond, where four urns containing ashes and burnd bones wer found inclosed in small separate stone chambers in different parts of the tumulus, but not within the central dolmen itself. Several kistvaens containing urns hav also been found near Cummer, County Wexford, one of which containd a large urn with a smaller one, handsomely ornamented, inside of it, but so far as known no ornaments or implements of any kind wer found in connection with any of them.* A third disposition is shown in the Queen's county interment previously noted, where the urn was placed by the side of the skeleton and within the kistvaen.

The cremation was sometimes accomplishd within the tomb, as appears from the account of a small kistvaen, approachd by means of a narrow passage way, discoverd immediately adjacent to the great mound of New Grange. "In it were a quantity of human bones and those of small animals, pigs, sheep, dogs, and fowl; some burned and some not bearing any marks of fire; but the most remarkable circumstance about it was that the bottom of this little chamber was lined with stones, the upper surfaces of which bore evident marks of fire—in fact, were vitrified—showing that the victim, or the dead body, was burned within the grave."†

Three distinct methods of urn burial in the County Antrim hav been described by Mr. J. S. Holden.‡ In the simplest form, several urns ar found imbedded in a layer of earth within a dolmen placed immediately upon the natural surface, without the protection of a surrounding mound. In another instance the kistvaen was approachd by a coverd passage and the whole structure inclosed in a parallelogram, sixteen by thirty-five feet, composed of twenty-six large pillar stones. The chard bones and fragments of urns wer found scatterd through the passage, showing that the tomb had been previously enterd and plunderd. In another instance a large urn was inverted within a small kistvaen placed at one end of a pavement formd of basaltic slabs, the whole inclosed in a mound. Within the mound, but outside the kistvaen, wer the fragments of several smaller urns. The remains in the principal urn seemd to be those of an old man of low stature. The urns found in each case wer similar and of very rude manufacture and wer frequently inverted upon a slab. Numerous flint instruments wer found and one glass bead, but no remains whatever of

* G. H. Kinahan, On a Circular Structure at Cummer, Co. Wexford, Jour. Anth. Inst., xii, 318–322, London, 1883.

† W. R. Wilde, The Boyne and the Blackwater, 2d ed., 203, Dublin, 1850.

‡ On Some Forms of Ancient Interments in County Antrim, Jour. Anth. Inst., i, 219–221, London, 1872.

metal. With regard to the authors of these Antrim tombs, Mr. Holden says: "Though the structural forms of interment differ so much over so small an area, yet it is highly probable that all were erected by the same race and people, who thus showed their reverence and respect for the dead, according to the rank they held while living. The total absence of metal, and presence of worked flint, do not allow their civilization to be placed higher than the Neolithic period."

In the manuscript narrativ of the Battle of Moytura, already referd to, there is an account of a Firbolg hero who lost his life in defending that of his king. The Firbolgs came up soon after, and each one taking a stone in his hand, they erected a monumental carn over the body, calling it the "Carn of the One Man." After reading the detaild account in the manuscript and going carefully over the ground, Sir William Wilde became convinced that the tomb was identical with a mound, crownd with a circle of standing stones, situated on the southern border of Lough Mask and known under the name of Carn Míniín Uisge.* The chief point in the identification was the vicinity of a remarkable wel, at which, according to the account, the king was surprised by his enemies. Procuring some men, Sir William put them to work excavating the mound, telling them beforehand that if it had not been already opend, they would find within it a chamber containing the remains of the Firbolg hero. True to the prediction they soon came upon a large horizontal flag, below which was another somewhat larger. On removing this latter it was found to cover a small square chamber twenty-eight inches high and thirty-seven wide, the walls of which wer formd of small stones. Within this chamber was found a small urn, of beautiful design and ornamentation, containing incinerated human bones. "Here, no doubt," says Wilde, "the body of the loyal Firbolg youth was burned, and his ashes collected and preserved in this urn. Perhaps a more convincing proof of the authenticity of Irish or any other ancient history has never been afforded."†

From this it seems evident that the Firbolgs practiced cremation, and the same account specifies four different classes of burial structures—mounds, hillocks, pillar stones and simple graves—which they erected over the slain, according to the rank of the warrior. The monumental pillar stone, sometimes bearing an Ogham inscription, in connection with the tomb, is frequently mentiond in the old manuscripts, and stone and tomb alike took their name from the hero whose remains wer there interd.

In the same manuscript is an account of a carn which the Firbolgs erected over the head of one of their slain heroes, which they recoverd from the enemy, while on the other hand the Tuatha-de-Dananns erected a monument over the severd arm of one of their champions, who afterward became king of Ireland under the title of Nuadhat (*Nuath*) of the

* Pronounced, Carn Meeneen Ishga, probably signifying "carn of the little watery plain."

† W. R. Wilde, Lough Corrib, 226, Dublin, 1867.

Silver Hand, the place of the missing member being supplied by an artificial substitute. As if in confirmation of these statements there is an instance on record where a stone coffin was discoverd in the County Wicklow, "just large enough to contain a small urn, which was inverted over two small bones belonging to human fingers and toes, and no other part of the body."*

The stone dolmens, sepulchral or otherwise, ar popularly known throughout Ireland as "giants' graves," and many stories ar current of giant skeletons found within them. It is hardly necessary to state that no such skeletons hav been found, the supposed giants' bones being probably those of some of the larger domestic animals which formd a part of the funeral sacrifice. The mounds and circular earthen forts, on the other hand, ar universally attributed to the fairies or "good people," who ar supposed to dwell within them, and so deeply is this belief rooted in the minds of the people that very few of the older ones would venture to lift a spadeful of earth or even to cut a bush from the neighborhood of such a structure. In some instances burial kistvaens have been found in the outer circumference of the rath, or earthen fort.

We hav thus seen that the ancient inhabitants of Ireland disposed of their dead by cremation, by disjointed burial and by extended burial, the first method being almost universal, while the last mentioned is rare and apparently of intrusiv origin. The human remains wer inclosed within an urn or stone coffin, the urn itself being sometimes within the coffin. The place of burial was sometimes unmarkd, at other times distinguishd by a pillar stone, a hillock, a dolmen, or an immense mound. Weapons, ornaments, and probably amulets wer buried with the dead, and there is abundant evidence that both human and animal sacrifice frequently accompanied the funeral ceremonies. The human victims wer probably prisoners taken in war and perhaps wer of a different race from that of the principal occupant of the tomb, while the animals slaughterd wer generally such as might hav furnishd a funeral feast to those in attendance. Should this picture seem dark to the patriotic Irishman he may find comfort in the reflection that exactly the same thing may be said of probably every nation in Europe.

Strabo asserts that at the beginning of the Christian era the Irish practiced cannibalism and regarded it as an honorable deed to eat the flesh of their dead parents.† With regard to this statement it may be said that, while this practice is widespread among savage tribes—founded, as it is, on the natural idea that by partaking of the flesh they imbibe the desirable qualities of the dead man‡—the Irish at that period wer already a

* W. R. Wilde, The Boyne and the Blackwater, 2d ed., 234, Dublin, 1850.

† Strabo, iv, 6, 2 and 4, quoted by Fligier, Mittheil. Anth. Gesell., ix, 249, Wien, 1880.

‡ Speaking of Australian funeral customs, a competent authority says: "I am, as I said, obliged to confess that the natives eat the flesh of some of their departed friends, and evidently think by so doing they are both benefiting themselves and conferring an honor upon the dead It is not done altogether from a craving after human flesh. * * * The reason, I am told, is that by partaking of the flesh of a person they inherit the virtues of that person." Albert McDonald, Mode of Preparing the Dead among the Natives of the Upper Mary River, Queensland, Jour. Anth. Inst., ii, 179, London, 1873.

civilized nation and not a horde of savages. As the island was never conquerd by the Romans the early geographers knew very little of the people or customs of the country, and Strabo's statement might be more worthy of attention had he not followed it up with an assertion which even the worst Hibernophobe wil hardly credit.

The Round Towers—Royal Burial.

Before leaving the ancient burial monuments it is necessary to speak of the round towers, concerning which there has been so much discussion. There ar nearly one hundred of these towers stil existing in Ireland in different degrees of preservation, the perfect specimens varying from seventy to one hundred and thirty feet in height and from eight to fifteen feet in diameter. Excepting in two or three instances the entrance is at a considerable distance above the ground, and each of the lower stories is lighted by a single window, while the uppermost story has four windows, facing the cardinal points. They have been assignd to every period from prehistoric antiquity down to the twelfth century, and their origin has been ascribed to Druids, Danes and Christian saints, while different writers hav seen in them sun temples, phallic monuments, beacon towers, minarets, burial structures, belfries, depositories for sacred vessels, penitential cels, anchorite hermitages and baptisteries. With all these theories, the balance of evidence is in favor of their remote pagan origin and connection with the ancient fire and sun worship of Ireland. Human skeletons, and sometimes cremated remains, hav been found interd within a number of those which hav been examined. In some instances the interment was evidently comparativly modern, a supposition renderd the more probable by the proximity of an old burying ground, but in at least one instance—that of the tower of Ardmore—the indications wer that the bodies had been laid to rest before the foundations of the tower had been completed.

In 1841, "Mr. O'Dell, the proprietor of Ardmore, in the county of Waterford, intended to erect floors in the tower there, and explored the interior of the tower down to the foundation. With considerable difficulty he caused to be removed a vast accumulation of small stones, under which were layers of large masses of rock, and having reached as low down as within a few inches of the external foundation, it was deemed useless and dangerous to proceed any further, and in this opinion some members of the society who had witnessed what had been done, coincided. In this state of the proceedings a letter from Sir William Betham was forwarded to Mr. O'Dell, intimating that further exploration would be desirable, upon which the latter gentleman, at great peril, commenced the task again. He now found another series of large rocks so closely wedged together that it was difficult to introduce any implement between them; after considerable labor these were also removed, and at length a perfectly smooth floor of mortar was reached, which he feared must be regarded as a *ne plus ultra;* but, still persevering, he removed the mortar, underneath

which he found a bed of mould, and under this, some feet below the outside foundation, was discovered lying prostrate, from E. to W., a human skeleton."*

In this instance it seems there can be no question that the interment was made at the same time that the building of the tower was begun. In some cases, however, the interment seems to hav been of secondary importance and rather accidental, and as before stated, the weight of evidence is against the sepulchral theory. Might not the Ardmore remains be those of a victim sacrificed to the earth spirit to insure the stability of the structure? Such sacrifice in connection with the erection of a new temple, bridge or fortress was one of the most widespread customs of antiquity, the victim being generally walld up alive within the masonry. The practice—now changed into animal sacrifice—stil exists among the peasantry of Servia and other countries in Southeastern Europe, and some popular house-building ceremonies point to the former existence of a similar custom in Ireland. Human sacrifice was one of the most important Druidic rites, and where would it seem more appropriate than in connection with the building of a Druidic temple?†

In the ancient Irish Annals we find a number of interesting statements in connection with royal burial in the early part of the Christian era. Thus the corpse of King Dathi, before being consignd to the tomb, was placed upon a bier by his clansmen and carried to the front of the battle to inspire courage in themselves and terror in their enemies. A similar incident took place within more recent times in an encounter between the rival forces of O'Neill and O'Donnell, subsequent to the Norman invasion. King Cormac Mac Art, who embraced Christianity long before the coming of Saint Patrick, is said to hav lost his life in consequence of the magic spels of the Druids, whose religion he had renounced. In his last moments he orderd that he should be buried at Ros-na righ (now Rosnaree in Meath) instead of with his royal predecessors at Brugh-na-Boinne, because the latter was a pagan cemetery. After his death his attendants, in despite of his injunctions, made three several attempts to convey his body to Brugh-na-Boinne, but were prevented each time by a sudden rising of the waters of the Boyne, until, regarding the occurrence as an omen, they finally dug his grave at Ros-na-Righ in accordance with his wishes. Laoghaire (Lairy or Leary), who ruled at Tara on the arrival of Saint Patrick in 432, was buried in a standing position in the outer rampart of his fortress, with his weapons and war dres upon him, and with his face turnd southward toward his enemies, the Leinstermen. This brings forcibly to mind Catlin's account of the burial of Blackbird, the great chief of the Omahas.‡

* Mr. and Mrs. S. C. Hall, Ireland: Its Scenery, Character, etc., ii, 57 note, new ed. R. Worthington, importer, n. d. (written about 1850). On page 203, Volume iii, of the same work, it is stated that *two* skeletons were thus found in the tower.

† See M. J. Walhouse, Some Vestiges of Girl Sacrifice, etc., in India and the East, Jour. Anth. Inst., xi, 415, London, 1882; F. S. Krauss, Das Bauopfer bei den Südslaven, Mittheil. Anthrop. Gesell., xvii, 16, Wien, 1887.

‡ George Catlin, North Am. Inds., 3d ed., ii, 5, New York, 1844.

The pagan Irish wer accustomed to bring home from the battlefield the heads of their slain enemies. The brains wer then taken out, mixd with lime and formd into a ball, which was hardend by exposure to the sun, and was afterward exhibited on public occasions as an evidence of bravery and a trophy of victory. There is an old legend that Mesgedhra, King of Leinster, lost his life in an engagement with the forces of Ulster, who took out the brains from the head and prepared them in this manner. But there was dread in Ulster, for a prophecy had gon forth that the dead Mesgedhra should yet avenge himself upon the men of Ulster. The brain ball afterward fel into the hands of the Connaught men, one of whom, placing it in a sling, threw it with such force at the king of Ulster that it was buried two-thirds of its depth in his forehead. The royal physician examind the wound and told him that to remove the ball would be instant death, but that he might liv for many years by abstaining from any undue excitement which might tend to loosen it. There was no appeal, and the king was forced to forego the battlefield, the chase and the banquet-hall, and become a solitary recluse. The years went on until one day, while sitting in lonely musing, an awful terror came over the king as he saw the noonday brightness suddenly darkend, while a single flash of lightning darted through the gloom and a peal of thunder shook the palace to its foundation. He sent for his druid to learn the meaning of the awful wonder, and was told that at that moment the Son of God had expired upon the cross. The druid went on to tel of the Savior's love, of the great atonement and of the agonizing death upon the cross, and how, even at the last, He prayed, not for justice or vengeance, but for mercy for his enemies.

"With a bound from his seat rose King Conor, the red flush of rage on his face,
Fast he ran through the hall for his weapons, and snatching his sword from its place.
He rushed to the woods, striking wildly at boughs that dropped down with each blow,
And he cried: 'Were I midst the vile rabble, I'd cleave them to earth even so!
With the strokes of a high King of Erin, the whirls of my keen-tempered sword,
I would save from their horrible fury that mild and that merciful Lord.'
His frame shook and heaved with emotion; the brain ball leaped forth from his head,
And commending his soul to that Saviour, King Conor Mac Nessa fell dead." *

In treating of the funeral customs of modern Ireland it must be stated at the outset that most of the beliefs and practices described ar rapidly dying out and ar now almost unknown to the younger generation in many parts of the country. They ar stil fresh in the memory of the older people, however, and ar yet in ful force in the remoter districts along the west coast, especially in Connemara. The decay of these customs is due largely to the rapid spread of education, which has taught the people the folly of many of the old beliefs, while the stirring political events of the last forty years hav left them little time for the observance of former ceremonies. Another cause is the general introduction of hearses and other wheeld vehicles, which hav to a great extent done away with "walking

* Death of King Conor Mac Nessa, by T. D. Sullivan.

funerals," as they ar calld. Another most important factor is the determind fight which the Catholic priests hav always made against the practices of the wake, until at last they hav almost succeeded in abolishing the custom. The old observances, however, had a strong hold upon the minds of the people and frequently come to the surface again when least expected. This was exemplified in a striking manner a few years since in the south of Ireland. A young man had died in a district in which the funeral cry had long fallen into disuse. Just as the procession was leaving the house his mother, or some near female relativ, broke into a passionate eulogy of the dead, when instantly every woman present, as if movd by a common impulse, raisd the *ullagone* and took her place behind the leader, and once more the wild wailing of the *caoine* floated over the hills until the corpse reachd its final resting place. Such is the power of an old custom acting upon impressionable natures at a critical moment.

Omens—The Bean-sighe and Fairy Influence.

The Irish hav a number of death omens, most of which ar common to the rest of Europe, and therefore need not be described here. Many of these ar taken from the actions and appearance of animals. Thus the howling of a dog presages the death of a member or relativ of the family, according as the animal looks toward the hous or away from it at the time. For this reason it is customary in Connemara when a dog howls at night to send some one outside to see which way the animal is facing. In the same way a dul ringing or crying sound in the right ear betokens the death of a near friend; in the left ear, that of a distant relativ. The same belief is held in Scotland. The croaking of a raven near the hous is also a fatal omen. Should a rooster fly up in the rafters and crow before midnight, it is regarded as a sign of an approaching death, and the omen is considerd infallible if the bird be a *Coilleach Martain* (pronounced *Cul-yakh Mawrthan*) or "March cock," that is, one hatched in March from an eg laid in the same month. There ar a number of strange beliefs in connection with the *Coilleach* Martain, which is thought to possess occult powers. The untimely crowing of a rooster is regarded as a death omen throughout Europe, and also in China, where several precautions ar taken to avert the threatend calamity.* Flies lighting upon the body of a sick person, or butterflies hovering about in the sick-room, also presage the approach of death, while of magpies it is said that

> "One is for sorrow, two for luck,
> Three for a wedding, and four for death." †

Great attention is also paid to dreams and to a hundred other things which are lucky or unlucky in their consequences, such, for instance, as

* A. M. Fielde, Chinese Superstitions, in Popular Science Monthly, xxxii, 798, New York, April, 1888.

† In Scotland it runs thus: "One bodes grief, two's a death,
Three's a wedding, four's a birth."
James Napier, Folk Lore or Superstitious Beliefs in the West of Scotland, 113, Paisley, 1879.

carrying fire out of a hous in which some one is lying sick, or meeting a hare or a red-haird woman when starting on a journey, all of which ar regarded as unlucky. Among the Galway fishermen a sudden blast of wind from the ocean is a sign that some one has just been drownd at sea. According to Lady Wilde, they say also that such an accident is often preceded by low music issuing from beneath the water—the melodies of the fairies who ar about to charm away the victim.* The same author states that there ar certain death omens connected with particular families. Thus in one family the omen is a mysterious crashing sound and a sudden blast of wind through the hous. The death of an officer in the Crimea was announced in this way, the news following immediately after the warning sound.† It is also believed that the spirit of one who is soon to die, altho perhaps in perfect health at the time, sometimes leavs the body by night and appears to some near friend, who thus has a certain warning of the approaching death.

But of all the beliefs in regard to death omens, the wildest and the most peculiarly Irish is that of the *Bean-sighe.*‡ This is the disembodied spirit of a woman who in former days was connected in some way with one of the old princely families of Ireland. The Bean-sighe never concernd herself with any of the upstart breed of the foreigner, but faithfully attended those of the ancient race even when, deprived of their possessions by war and confiscation, they sank to the level of peasants and laborers, and instances ar related where she has even followd their decaying fortunes in their exile beyond the ocean. Her mission is to giv warning, by a plaintiv wailing cry, of the near approaching death of one of the family, and this cry is repeated at the moment when the soul leavs the body. This belief, which has been called "the wildest and grandest of all the Irish superstitions," has its parallels on the continent, the most notable example being that of the spectral "White Woman" who waits upon the royal family of Prussia, but these ar isolated cases, while in Ireland the Bean-sighe is a part of the popular belief throughout the country. The spirit is generally heard at night, sometimes at midday, and very rarely in the morning. The mournful cry is generally the only indication of her presence, but in a few instances she has been seen for a moment as a rapidly receding figure having the appearance of a witherd old woman clad in

* Lady Wilde (Speranza), Ancient Legends, Mystic Charms and Superstitions of Ireland, i, 151, London, 1887. While this work—in two volumes—necessarily contains a number of valuable points, it is a real disappointment when we consider the exceptional opportunities enjoyd by the author during a life-long residence in Ireland, half of which was spent in the wildest districts of Galway. Of legends there ar hardly any beyond a few local traditions, while the statements in regard to the popular customs and beliefs ar all loose and fragmentary and ful of vague theorizing. The best portions of the book ar those taken from the writings of the late Sir William Wilde, the distinguished husband of the authoress, and a man wel versd in all that pertaind to the national life of the people.

† Idem, i, 266.

‡ Pronounced, and commonly written, *Banshee.* From *bean* "woman" and *sighe* "spirit."

flowing white drapery. The Bean sighe is generally anonymous, like the Puca or Leprechán, but a few of the more noted ones hav special names. Thus the Bean sighe of the O'Neils, the ancient royal race of Ulster, is called Maoveen. She frequented their ancestral seat, Shane's Castle in the County Antrim, where it is said that "to hint a doubt of the existence of the Banshee of the O'Neils would, in the estimation of their people, be tantamount to blasphemy."* The cry of the Bean-sighe, which has been likend to the sound of the caoine, resembles the mournful sighing of an autumn wind, tremulous, rising and falling, and audible at a great distance, while something human runs through all the tones. At times she seems to clap her hands while wailing, like the women around a corpse. The cry is usually heard by all those in the hous, but in some cases is distinguishd only by one specially gifted. A few instances wil illustrate this belief. The first, from Hall's Ireland (iii, 106 note), was related by an old school-master concerning one of the MacCarthys, once a ruling family in the south of Ireland :

"'My father's family,' said he, 'were ill of '"the sickness"'—so the fever is commonly called—'his neighbor, a poor widow, one MacCarthy, had her son sick also; my father went to her and begged her not to screetch when the life left the boy, for fear of frightening my mother. She promised that with God's help she wouldn't. Well, at midnight we heard a scream—a loud and sorrowful and awful scream : we all heard it ; and my father went out to the widow to complain that she had broken her word. He found her at home : she said her son was dead, but she hadn't crossed the doorway, keeping the grief in her heart. So he went homewards, and again he heard the voice ; and he followed it for above a mile : and at last it left him at the north end of a stream.'"

The Bean-sighe sometimes givs warning of the death of a relativ in another country. Of this we have an instance in the work just quoted (iii, page 108 note), related by a respectable woman who solemly averd its truth : "When a little girl her father and mother had gone out to a wake and had left her, along with her younger sisters and brothers, in care of the house. They were all, four or five in number, gathered round the fire. Suddenly they heard a melancholy cry, as of a woman approaching the house. They ran to the door, supposing it might be the daughter of the deceased person, who was coming to borrow something for the wake ; but, to their great dismay, saw no one, though they still heard the cry, passing as it were by them and down along on their right. Upon their father's return they told him what had occurred. 'Don't mind, girls,' said he,

* Mr. and Mrs. S. C. Hall, Ireland, Picturesquely Illustrated ; Its Scenery, Character, etc., iii, 104, new edition, New York, n. d. (about 1850). This is one of the best general books upon Ireland ever written, as the authors wer wel acquainted with the country and thoroughly understood the character of the people. It abounds in valuable folk-lore material. Although stories of the Bean-sighe ar common among the people, I have chosen rather to give these published instances on account of their typical character and in order to call attention to the work quoted.

'perhaps the person whom that cry lamented is not one of us, or it may be that he is far away.' In a fortnight after they received intelligence from London that an uncle of theirs, a physician, had died there on the very night they had heard the Banshee cry. They were MacCarthys by the father's side and O'Sullivans by the mother's."

The spirits of the dead ar sometimes allowd to revisit the earth to join in the lamentations over the corpse of one of the family. On the river Flesk in Kerry is a high clif overhanging the water and taking its name from a young girl called Reinarth Bresnahan. Years ago she went out one day to look for some cows which had strayd into the mountains. She never returnd, but when last seen alive she was standing on the top of this clif and may have fallen into the water below. At each successiv funeral in the family from the time of her disappearance she would be seen to enter the room, appearing in dres and features just as she did on the day she left the hous for the last time, and would join in the *caoine* over the corpse. The others could see her, but wer afraid to speak to her. Once she was heard crying outside the hous, and soon after came the news that one of the family had died in America. The last of the Bresnahans died about fifteen years ago, when she came once more to join in the caoine and then disappeard forever.

The belief that sickness and death ar due to the evil influence of spirits is common to all savage races as wel as to the uneducated classes among civilized nations. In Ireland, where the fairy mythology reachd a high development, this belief is carried stil further, and it is thought in many cases that the sickness or death is only apparent, the supposed invalid or corpse being merely a substitute left by the fairies instead of the real person, whom they hav carried away.* Altho seeming to lead a joyous existence, dancing by moonlight in the green fort to the sound of soft music, or holding high revel in their underground palaces, the fairies ar constantly haunted by the fear of eternal condemnation at the last judgment. To avert this doom they seek to ally themselvs with the mortal race, and ar constantly on the watch to carry off men, women and children to serv as husbands, wives or nurses in the fairy court. The prisoner, however, must be releasd at the end of a certain period, unless he should be so unwise as to taste of the fairy food in the meantime, in which event he becomes dead to his friends and can never return. Exactly the same belief is held by the Dakota Indians, as appears from "A Yankton Legend," one of the collection of Siouan myths and stories by J. Owen Dorsey, which will appear in the forthcoming Volume vi of Contributions to North American Ethnology. The people tel many stories of persons who wer thus carried off by the fairies, but found means to warn their friends to leav food where they could get

* For a more extended notice of the fairy influence in sickness, see the author's paper on "The Medical Mythology of Ireland," in Proceedings of the American Philosophical Society, xxiv, 133–166, Philadelphia, 1887.

PROC. AMER. PHILOS. SOC. XXV. 128. 2H. PRINTED DEC. 27, 1888.

it while on their nightly excursions with the "good people," who wer consequently compeld to releas them at the end of the term of three, five or seven years. I hav talkd with a number of persons of fair intelligence and education, and of varied experience, who believ and insist that their own parents, brothers or sisters wer thus carried off by the fairies, altho to all appearances they died and wer buried in the regular way. On the west coast, when a man is drownd and his friends fail to recover the body, it is known that he has been taken by the fairies and is stil alive in their caves at the bottom of the ocean. They ar sometimes seen by their former friends on their fishing trips, and in a few instances hav been allowd to return to the land of the living.. A single story, told by a Roscommon woman, wil show the belief on this subject. It was related as an incident within her own knowledge, and the fairy fort referd to was in her uncle's field near Ballintubber.

A woman named Nancy Flinn was one day going to see her sister when, as she was passing near the fort, she saw a number of young men, all of whom wer strangers to her, playing hurley in the field. As she came up one of them approachd her and said, "My good woman, you go back and take another road to your sister's." She paid no attention, but kept on, when he again warnd her to turn back. Some time after, while milking, she suddenly fel down and began calling for help. As her husband came running up she cried out, "O, Ned, hold me!" He could hear the sound of blows, while she screamd at every blow. He carried her into the hous and put her to bed, but she lingerd only a short time and then died. A neighbor and his wife went to see her in the evening, and left the hous just as she drew her last breath. On their way home they stopd at the narrator's hous, pale and trembling with fear, and said that in passing the fort they had seen it all lit up with a thousand lights, and had heard sounds of rejoicing and voices crying, "We hav her at last, we hav her at last; but, Nancy, it was hard to get you."

When it is suspected that the dead person has really been carried off by the fairies, his friends ar accustomd to leav food or milk where he can get it during his nightly visits in company with the "good people," in order that he may not be obliged to partake of the fairy food. On this subject Lady Wilde incorrectly states that " it is a very general custom during some nights after a death to leav food outside the house—a griddle cake or a dish of potatoes. If it is gone in the morning the spirits must have taken it, for no human being would touch the food left for the dead."* The truth of the matter is that the food is left, not for those who ar known to be dead, but for those who ar believd to be stil alive, altho held in captivity by the fairies. On November night, however, food is left in readiness for the spirits of the dead, who then revisit their former homes, while it is a common thing to propitiate the fairies in like manner at all seasons of the year.

*Lady Wilde, Ancient Legends of Ireland, i, 225, London, 1887.

Immediately after death the soul appears before the judgment bar, and is sometimes condemd to return and reanimate the body during a further term of sickness until by suffering it has been renderd worthy to enter heaven. The fairies take advantage of its temporary absence to put one of their own number into the body, so that when the soul returns it finds its place occupied and is obliged to go with them. When this is thought to be the case—as evidenced by the lingering, altho plainly hopeless, nature of the ilness—the friends of the sick man put a piece of *lus-mór* (pronounced *lusmore*, Gaelic "great herb") or foxglove under his bed. If he be a changeling the fairies wil at once be compeld to restore, in good health, the person taken away. If the invalid be really present in his proper person he wil not recover, but die. The idea that the destruction or loss of the body forces the soul to become a wanderer is common to many primitiv nations, and is at the bottom of Egyptian embalmment as wel as of the Christian horror of cremation. I have not met with any other indication of such a belief in Ireland, but in one of Lady Wilde's legends the fairies, who hav captured a wicked old hag, ar represented as saying: "Her soul will never rest in peace, because we shall cut up the body in little bits, and the soul will not be able to find it, but wander about in the dark to all eternity without a body."*

Properly speaking, the fairies hav no power to take life, but there is another class of spirits altogether malignant, which haunt particular localities, hovering invisible in the air overhead, and visit destruction upon all who come within their reach. Should an unaccountable sickness or death occur in a new hous, it is ascribed to the presence of one of these spirits, and the owner will tear down the hous and rebuild it in another place.

Dying Rites—Laying Out—The Máistinidh.

The Irishman obeys the injunction to remember his last end, and his constant prayer is to be deliverd "from a sudden or unprovided death," and to have a "decent funeral." The poorest old woman wil hoard up year after year from her slender means in order that she may be buried respectably when life's struggle is over, and above all, that she may not have a pauper's funeral, while the most poverty-stricken family wil strain every nerv to perform the same office for the departed father, mother, brother or sister. In Scotland, "The first care of the young married wife was still, in my young days, to spin and get woven sufficient linen to make for herself and her husband their *dead claes*."† So strong is this feeling that the clergy frequently find it necessary to warn their people against the reckless extravagance common on such occasions. The ancient and widespread practice of expensiv funeral feasts and ceremonies undoubtedly had its origin in the desire that the soul should enter the spirit

* Lady Wilde, Ancient Legends of Ireland, i, 138, London, 1887.

† James Napier, Folk-Lore, 55, Paisley, 1879.

land with all its wants wel provided for, altho in modern Europe it has come to be regarded only as a fitting tribute of respect to the departed.

As soon as an ilness assumes a serious character the priest is sent for to hear the sick person's confession and help him arrange his affairs, after which the dying man awaits the end with composure and resignation. There is a general desire that death, when it comes, may occur upon Friday, the day on which Christ died, and in the west the prayer is for *Bás Aoine, guid'e Sat'urn agus ad'lacad' Dom'nac'.** "A Friday death, a Saturday prayer and a Sunday funeral." When it is evident that death is near at hand the priest is again calld in to administer to the dying man the last sacraments of the church. The blessed candles, which hav been consecrated in the church on some previous Candlemas day, ar then lighted in the room and the friends recite the prayers for the dying. In Kerry and other parts of the west twelv small wax tapers which hav been thus blest, and corresponding to the number of the apostles, ar fixd upright around the edge of a plate and past from hand to hand in a circle from right to left around the head of the dying man, by relativs standing near, who recite during the while the following prayer: *Gui l'im Peadar, guid'im Pól, guid'im Muir' oig' agus a Mac, guid'im a dá easpal déag, gan tu d'ul ann eug gan a g-cead,*† "I implore Peter, I implore Paul, I implore the Virgin Mary and her Son, I implore the twelv apostles, that you may not enter death without their permission." When death comes, after reciting this prayer, it is thought to be in accordance with the wil of God and the saints. In the western islands twelv lighted rushes ar placed around the bed of the dying man.‡ A similar practice probably prevaild formerly in the east, according to the statement of a woman of the County Meath. Her father past away so quietly that it was several minutes before the fact of his death was discoverd, when his wife, who was alone with the children, lighted a taper and held it between his claspd hands while she recited the prayers for the dying. This was fifty years ago, when Gaelic was stil the language of the district. The dying person takes "three breaths of life" just before expiring, and a man always falls asleep at the approach of death, while a woman remains awake. Along the coast we find also the old belief that life goes out with the ebbing tide.

When the dying man seems to suffer great agony it is thought to be due to the presence of chicken feathers in his bed, and his friends wil sometimes lift him up and place him upon the floor to rèliev him. Some persons go so far as to say that feathers of any kind wil caus the sick one to "die hard." It is possible that there may be some physiologic reason for this belief, as the senses of the sick ar frequently alive to odors and atmospheric influences imperceptible to those around them.

* Pronounced in Connemara, somewhat incorrectly, *Baws Ena, gwĭva Sădrn ŏgus iel-akhawn Dhonakh.*

† Pronounced in Kerry, *Gweeim Pădhar, gweeim Poel, gweeim Mwir' oeg ŏgus a Moc, gweeim a dhaw awspal jaeg, gun thu ghul an yaeg gun a gadh.*

‡ Lady Wilde, Ancient Legends of Ireland, i, 224, London, 1887.

In Connemara when one is dying of consumption it is customary to tie some unsalted butter in a piece of cloth and hang it up in the rafters. Just as the sick person is at his last gasp all of his blood relativs leav the hous and remain outside until he is dead. As he draws his last breath the consumption leavs his body and enters into one of his relativs, should any be present, but finding none of them in the room, it goes up into the butter, which is then taken down and buried. In some parts of Galway this is said to keep off the disease only for a term of seven years. On asking how long the friends remaind outside, my informant replied, "They stay out til he's dead—and wel dead."

From Jeremiah Cŭrtin, of the Bureau of Ethnology, I learn that a somewhat similar practice formerly existed in Vermont, where within living memory the dead body of a consumptiv was dug up, and the heart taken out and burnd, under the impression that this would prevent the recurrence of the disease in the family. Among the Jews, also, the nearest relativs leav the hous just before the death struggle comes on.

As soon as life is found to be extinct the neighbor women take charge of the body, which is washd and drest and stretchd upon a board resting on a table or the backs of chairs. The corpse is generally drest in a shroud, together with the scapular or other insignia of any religious order of which the deceasd may hav been a member. The shroud, towels and other clothes used in connection with the funeral ceremonies ar all of linen and ar commonly preservd in each family for this purpose alone. After the funeral the towels, etc., ar washd by the nearest female relativs of the deceasd, no indigo being used in the process. The corpse is laid out facing the east, or rather the south-east, that is, with the head to the west and the feet to the east, and is buried in the same position whenever possible. The custom of burying the dead facing the east is common to many European and Oriental peoples, having also been practiced formerly by the Choctaws and other Indian tribes of the Southern States,* and had its origin in sun worship. The Irish explain it by saying that the east or south-east is holy, while the evil spirits always come from the north—and here again we see the remains of the old element worship which regarded the rising sun, the warm southern breez and the cold northern blast as good or bad spirits according to their effects. In allusion to this custom there is a current saying in Connemara, when one person quarrels with another, *Nar bud' fada go d-tí'n ceann caol siar d'uit*,† "May it not be long until the little end of you is to the west." In the east they say, "May I liv to see you stretchd on the board."

Two evil spirits known as the *Máistínid' Mór* (*Mawshchenee Moer*) or Great Mastifs ar constantly waiting to seiz the soul before it can reach the judgment bar of God. They ar asleep, but spring up at the first sound of grief. For this reason the corpse is laid out as soon as possible, and no cry or lamentation is raised, *in theory*, for three hours after death, by

* James Adair, Hist. Am. Inds., 182, 1775.

† Pronounced, *Nawr bă fŏdha gă jee'n can cueel sheer ghueeth*.

which time the soul stands in the presence of its Maker and is safe for the time being. It is there weighd in the scales of the Archangel Michael and receivs its sentence of reward or punishment according to the measure of its iniquity. The belief that the souls of the dead ar weighd by the angel Michael prevails all over Europe, and is noted in one of Ralston's Russian Fairy Tales. The idea comes down to us from remote antiquity. At the ruins of Monasterboice abbey, near Drogheda, founded in the sixth century, is a sculpture representing the judgment, in which one figure is weighing the souls in a balance,* and precisely the same thing is portrayed on a Japanese picture of the judgment, recently exhibited in Washington, the original of which dates back for centuries. Should its load of sin carry the soul to the bottom of the scale, the *Máistínid'* seiz it and drag it down into hel. There seems also to be an indistinct belief, common to many primitiv peoples, that the soul hovers near the body until the latter is finally laid at rest in the grave. As the *Máistínid'* ar particularly alert just before daybreak, great care is taken that there shal be no crying at that time during the few days intervening between death and burial, and one of the most dreaded maledictions in the west of Ireland is *Sgreada na maid'ne ort,*† "The cry of the morning on you!" In some districts, according to Lady Wilde, "when a death was expected it was usual to have a good deal of bread ready baked in the house in order that the evil spirits might be employed eating it, and so let the soul of the dying depart in peace."‡

The manner of laying out the corpse preparatory, to the wake differs somewhat in various districts, but the principal details are the same. In Meath the body was placed upon a board frame like a door, which rested upon a table, but was somewhat wider than it, so as to project beyond it on the right side. The frame and table ar coverd with a white sheet reaching down to the floor. The body, drest in its shroud, is extended upon this sheet, with the feet toward the east, being placed upon that part of the frame resting immediately upon the table. Another sheet is thrown over the corpse so as to conceal it from view. Along the projecting edge of the frame ar placed several plates containing pipes and tobacco for the watchers and attendants at the wake. In this part of the country the plate was never placed at the head, foot or upon the breast of the corpse. Between the plates ar large blessed candles, which ar lighted and kept constantly burning as long as the corpse is in the hous, the rule being to keep the body for two nights and bury it on the third day. During all this time the body is never left alone, but is watchd day and night by friends of the deceasd, of about the same age, the men sitting up all night until relievd by the women in the morning. In some districts the body of an adult is sometimes adornd with black ribbons, that of an unmarried person with white ribbons and that of a child with flowers. In

*.W. R. Wilde, The Boyne and the Blackwater, 2d ed., 303, Dublin, 1850.
† Pronounced, *Shgrădha na mŏnya urth.*
‡ Ancient Legends of Ireland, ii, 118, London, 1887.

the west and some parts of the north the plate of tobacco is placed upon the breast of the corpse. According to Hall,* a quantity of salt is usually placed upon it also. I hav not met with this practice, but in Connemara those who attend the wake or funeral put some salt into their pockets before leaving home, and take some in their mouths before eating anything on their return. Salt is believd to keep spirits at a distance, and the spirit in this instance seems to be the ghost of the deceasd. In Scotland a plate of salt was formerly placed upon the corpse, the purpose being to keep the devil from disturbing the body.† In Ireland, as elsewhere, there ar many curious beliefs in regard to salt. In Cork the tobacco and pipes ar placed just above the feet of the corpse, while in Antrim they ar placed on a separate table. The corpse thus laid out is said to be *os cionn cláir* (*ŏs cin clawr*) or "over board." In Carleton's account of the old wake ceremonies in some of the northern counties he says that the corpse is sometimes laid out *under* a deal board (under board) with a sheet thrown over the body so as to conceal it, or is sometimes allowd to rest in the bed, with the face uncoverd, while sheets with crosses upon them ar pind up about the bed on all sides excepting in front.‡ He also refers in another place to a curious belief of whose existence in Ireland I hav no further knowledge, altho it is common to many uncivilized tribes, viz.: That if the corpse be buried with the feet tied the spirit will be hinderd in its movements in the next world.§ If there be a clock in the hous, it is stopd until after the funeral, a custom observd also in Scotland. Should the corpse remain "lumber" (limber) after laying out, there will soon be another funeral in the family.

The Wake and Caoine.

We now come to the Wake, calld in Gaelic *tóram* (*thoru*), concerning which most of us hav heard so much and yet know so little. There is a prevalent impression among some who should know better that the Irish wake is a mere drinking orgy on the occasion of a funeral, but to the student of human development it appears something very different—a survival of an ancient death rite which is older than history and was once almost as widespread as the human race itself. While the wake, with its curious mingling of grief and hilarity, of wild lamentation and boisterous revelry, seems strangely inconsistent when viewd in the light of our

* Mr. and Mrs. S. C. Hall, Ireland, Picturesquely Illustrated, i, 222, n. d., New York, R. Worthington, importer.

† James Napier, Folk Lore, or Superstitious Beliefs in the West of Scotland, 60, Paisley, 1879.

‡ Wm. Carleton, "Larry McFarland's Wake," in Traits and Stories of the Irish Peasantry, i, London, 1853. This work—consisting of five volumes in this edition—is invaluable to the student of Irish folk-lore, the more so as it describes customs and beliefs prevalent seventy years ago in eastern Ulster, a part of the country from which they hav now almost entirely disappeard. The author was an Irishman by birth and education and thoroughly in sympathy with the people.

§ "The Party Fight and Funeral," idem, ii, 113, London, 1853. See also page 244, of this paper.

modern civilization, it would appear perfectly natural and proper to the nativs of almost any part of Asia or Polynesia, or to the people of ancient Greece, Rome, Carthage or Egypt.

Among ancient and modern nations the original purpose of the wake, with its games, watching and lighted tapers, appears to hav been twofold: To divert the grief of the survivors and to protect the body from the attacks of evil spirits until it was safely disposd of by cremation or burial. In addition to this it must be rememberd that with the peasant class of modern Europe, whose toils ar constant and amusements few, a wedding or a funeral affords almost the only opportunity for a friendly gathering of neighbors to break in on the dul monotony of every-day life. Napier, in his work on Scotch folk-lore, describes wake customs similar to those of Ireland and says: "The reasons given for watching the corpse differed in different localities. The practice is still observed, I believe, in some places, but probably now it is more the result of habit—a custom followed without any basis of definite belief, and merely as a mark of respect for the dead; but in former times, and within this century, it was firmly held that if the corpse were not watched the devil would carry off the body, and many stories were current of such an awful result having happened." And again: "The wake in the Highlands during last century was a very common affair. * * * Pennant, in his tour through the Highlands, 1772, says that at a death the friends of the deceased meet with bagpipe or fiddle, when the nearest of kin leads off a melancholy ball, dancing and wailing at the same time, which continues till daybreak and is continued nightly till the interment. This custom is to frighten off or protect the corpse from the attack of wild beasts, and evil spirits from carrying it away."* Whatever we may think of the wake, it is certain that those who take part in it believe they ar paying a tribute of respect to the dead, altho in former days the intemperate use of liquor, together with the strong factional feeling of the last generation, frequently led to disgraceful scenes, while the whole practice is so incompatible with modern ideas that for years the clergy hav made every effort to abolish it entirely.

As soon as the news of the death gets abroad the friends begin to arrive to pay their respects to the deceasd. They never enter the hous singly, but should one come alone he waits on the outside until joined by one or two others, when they open the door a little way, take off their hats and recite in an undertone the prayers for the dead. Then entering the room, they salute those present, take seats and join in the conversation. As a rule, only near relativs join in the caoine or kneel down to pray by the side of the corpse. The friends arrive all through the day, some coming from long distances, and by nightfall there ar as many present as the hous can wel accommodate. In the ordinary cabin, consisting of but two rooms, the corpse is laid out in the middle of the kitchen, while seats ar arranged

* James Napier, Folk Lore or Superstitious Beliefs in the West of Scotland, 62, 65–6, Paisley, 1879.

around the wall for the visitors. When the hous has several rooms the company assembles in one, leaving the corpse to be guarded by a few watchers in another room, and if there be a barn close at hand the young folks usually adjourn to it early in the evening in order to enjoy themselvs without interruption. The men, and frequently the women as wel, help themselvs to the pipes and tobacco, and in the old times whisky was also servd out at intervals to the entire company. For each pipe of tobacco used the smoker is expected to say a short prayer for the repose of the soul of the dead, the regular Gaelic formula being: *Seac't lán reilic Pad'ruig agus tomba C'ríosd go b'eannac'taib' le h-anam na marb,** "Seven fuls of the cemetery of Patrick and the tomb of Christ of blessings with the soul of the dead," while the English speakers say, "God hav mercy on the soul of the one this pipe was over."

While the family and the caoiners sit or stand about the corpse the others pass the time in smoking, gossiping, telling stories, singing songs and playing games, all of which seems strangely out of place in the presence of death. At intervals one of the company will say, "Let us repeat a Pater and Ave for the soul of the dead," when all rise and say a short prayer in silence, after which the talk and merriment go on as before. The only other interruption is that occasioned by the caoine, which is raisd when the body is first laid out, and repeated on the entrance of each relativ or near friend.

The custom of a public funeral lament for the dead comes down to us from the earliest times, having been common to all the nations of antiquity, and is stil practiced in India, Arabia, Abyssinia, Australia and among some tribes of the American Indians. Numerous references in the Bible show that it existed among the Hebrews. Homer represents the women as wailing and reciting eulogies over Hector's dead body, and in ancient Rome we find laws in regard to the *præficæ* or mourning women. From J. Owen Dorsey, of the United States Bureau of Ethnology, I hav obtaind a description of a funeral lament which he heard among the Osage Indians, in which the words, the intonation and the motions of the wailers wer exactly similar to what we find in the Irish caoine. According to Francis La Fléche their kindred, the Omahas, hav but one formal lament. Among all nations this duty seems to hav been left to the women, as beneath the dignity of a man.

In Ireland the funeral lament is calld *caoine* (almost *cena*) by the Gaelic speakers, while the corrupted form, *keen*, is used by the rest of the population. The woman who leads the lament is calld the *Bean Caointe* (*ban ceencha*) or "crying woman," and is generally selected for her fine voice and skil in improvising. When she is a near friend of the deceasd she givs her services as a labor of love; otherwise she receivs a small sum according to the ability of the relativs. It must be rememberd that it requires some special qualifications to lead the caoine properly, and that

*Pronounced *Shŏkhth lawn rel-yic Fawrig ðgus thomba Khreesdh gó vănakhthee lae hŏnam na mŏraw'*.

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every wake necessitates an attendance of several days. In Galway there is a class of women known as knitters, who travel about from place to place knitting stockings, mittens and caps for the peasantry, and from their intimate acquaintance with the life histories of their customers, and their readiness of expression in song or story, they ar usually in demand on such occasions.

As soon as the body is laid out the friends kneel down and pray. Then rising, the women range themselvs around the corpse, and the Bean Caointe, advancing, stretches out her hands for a moment over the body, and then, lifting them suddenly over her head, breaks out into the wild lament. When she pauses at the end of a stanza, the other women take up the mournful chorus, moving their bodies slowly to and fro and clapping their hands in front of them in keeping with the measure of the chant. Then the Bean Caointe begins another stanza, which is followd by the chorus in the same way, and so on to the close. The caoine is repeated each night about 10 o'clock, each morning soon after daybreak, and on the arrival of any relativ who may not hav been in at the beginning of the wake. In the latter case the new comer kneels down beside the corpse and recites a short prayer, then rising together with the women he joins them in repeating the cry, after which he takes his place with the rest of the company, who ar indulging in jokes and small talk, games and stories during the intervals of the caoine.

As the funeral leavs the hous the women form in line behind the coffin and the caoine is raisd again, the wailing chorus now swelling loudly upon the breez and again dying away into silence, until the churchyard is reachd. As the coffin is lowerd into the grave the cry rises for the last time with all the agony of the final parting, and the excitement for some moments is something awful. In Meath all the women of the neighborhood formerly walkd behind the coffin, from three to five abreast, and the cry was raisd by those in the first row, then taken up by those in the second, and so on to the last, when those in the front row began again. The cry while walking with the funeral is generally only a wailing chorus. It may be heard to a great distance and long before the funeral is in sight. In this county it used to be said of one noted for attending wakes, "You're as fond of a funeral as Denning's dog." Denning lived in Navan and ownd a dog which used to jump up whenever he heard the cry and follow the funeral until it reachd the churchyard. In Connemara there is no caoine during the procession. In Kerry one-half the women walk in front of the coffin while the others come after it, and the caoine is raisd alternately by each party. In the north also the women frequently walk in front.

The impression made by the caoine, with the passionate eulogy of the Bean Caointe and the wailing chorus of the women, is thus described by competent witnesses: "The Irish language, bold, forcible and comprehensive, full of the most striking epithets and idiomatic beauties, is peculiarly adapted for either praisė or satire—its blessings are singularly touch-

ing and expressive, and its curses wonderfully strong, bitter and biting. The rapidity and ease with which both are uttered, and the epigrammatic force of each concluding stanza of the keen, generally bring tears to the eyes of the most indifferent spectator, or produce a state of terrible excitement. The dramatic effect of the scene is very powerful: the darkness of the death-chamber, illumined only by candles that glare upon the corpse—the manner of repetition or acknowledgment that runs round when the keener gives out a sentence—the deep yet suppressed sobs of the nearer relatives—and the stormy, uncontrollable cry of the widow or bereaved husband, when allusion is made to the domestic virtues of the deceased—all heighten the effect of the keen; but in the open air, winding round some mountain pass, when a priest or person greatly beloved and respected is carried to the grave, and the keen, swelled by a thousand voices, is borne upon the mountain echoes—it is then absolutely magnificent."*

The music of the caoine has its traditional origin in the wail of the Bean-sighe, and in the manuscript Book of Ballymote there is an ancient funeral lament which is recorded as having been sung by a chorus of invisible spirits over the grave of an Irish king in the tenth century.† With regard to the subject matter of the caoine it is difficult to say much, or to give specimens, as the principal part is usually improvised on the spot and forgotten with the occasion which calld it forth. It is recited in a measurd chant, each line ending in a crescendo, dying away at the beginning of the next. The wailing chorus is a long tremulous *ochón, ochón eile, ullulu* or *ullagón*. In Connemara the criers use ochón, ochón eile, ochón eile (*okhoên ella*), while in the south ullagón is more common and may be a corruption of the same expression. *Ochón* is the Gaelic equivalent for *alas!* and *eile* signifies *another*, so that ochon, ochon eile, may be rendered, "Alas, and again alas!" The stanzas ar composd the more readily from the fact that Gaelic rhymes ar vocalic only, and it is sufficient that the final vowel sounds of corresponding lines be the same.

The caoine itself strikingly resembles the Indian death song. It is a lament for the dead in which the speaker eulogizes the virtues of the deceasd and makes touching allusion to little incidents in his history, and should it be the case that he has come to his death by violence, as has happend too often in the troubled condition of the country, the most withering curses ar calld down upon the head of the slayer. We giv here specimens of caoines which hav been preservd among the people, but as before remarkd the great majority ar forgotten almost as soon as utterd. There ar, however, numerous elegies of more finishd composition, written by Gaelic poets within comparativly modern times, which ar wel known in the districts of the south and west where the language is stil commonly spoken. The first is given in Hall's Ireland as the literal translation of a

* Mr. and Mrs. S. C. Hall, Ireland: Picturesquely Illustrated, i, 225, n. d., New York.

† Idem, ii, 408 note.

caoine stil preservd in Antrim. It is said to hav been composd by a daughter of the O'Neils over the body of a former lover, who, having gon to some foreign land, returnd after a long absence, only to find that she had yielded to the persuasions of her relativs and was about to become the bride of another. The news struck him down like a blow and the girl did not long survive the shock :

"My love, my love, and my treasure,
Many a day have you and I spent
Beneath the shade of yonder tree,
Thy fair head on my lap.
Sweetly didst thou kiss me;
And it was not a kiss without love
That thou didst press upon my lips:
But woe is me! women believe not men,
There is so much deceit and falsehood.

"My love, my love, and my treasure,
Did I but know then
Half what I do know now,
I would plough with thee the hills,
I would swim with thee the seas,
Though my kindred might upbraid me:
But what were that to me,
If he who loved me were mine?

"Beloved of my bosom,
Thy heart found no repose,
When my story was told thee
That I was the bride of another—
Yet Heaven knows, the only Son knows,
That I would prefer thee
To all the gold of Erin—
To young oxen on the hills,
And to him with all his herds.
And the only Son knows
That I will never lay beside him
My right side nor my left."*

The next, from Kerry, was obtained from an old man who is one of the few having a literary acquaintance with the Gaelic. It is the lament of a woman over the body of her son's wife :

Bud· d·eas liom a t-seasam· t·u agus bud· d·eas liom a t-suid·e t·u,
'S bud· g·eal-dearg air m·argad· an rig·e d·uit,
A díol do c·uid t·orrt·a 's a glacad· do c·íosa.
Nuair-a t·ainic tu a b·aile níor t·roid agus níor bruid·ean duit,
Ac·t breit· air do leanb· agus é c·asad· er a c·ín c·ugad—Ullagón!

Is minic-a c·onnarcsa bean mic agus mat·air céile
Mar b·eid·ead· cat agus luc· air ag·aid· a c·éile;
Ní mar súd-a b·id·innse agus mo c·eud-searc.
Do b·í ár d-toil do g·ul a c·éile;
Do b·í ár n-daonnac·t ag imeac·t a n-aonac·t.
'Sé mo cruad·tan oir luat·ad· eugais
Go d-teic· do t·uarasg air fad na h-Éireann!—Ullagón!

* Mr. and Mrs. S. C. Hall, Ireland, Picturesquely Illustrated, iii, 113, n. d., New York.

Is mait· a tá f·ios agamsa an lá t·asduig·ead· tu uaimse—
Lá na cuiginne brisead· agus do b·uailead·,
Lán lion a c·uir a g'críoc· go luat· d·am,
Lá na bairg·eana léat·ad· agus do s·uait·ead·,
Lá mo c·uid eudaig· néatac· t·uarad·,
*Agus lá mo b·áis mo 'cán cruad· t·u !—Ullagón !**

Which may be thus rendered :

You wer beautiful to me standing and you wer beautiful to me sitting,
And you wer fair and rosy in the king's market,
When selling your produce and receiving your rents.
When you came home you wer not fighting and quarreling
But taking your child and turning it on your bosom.—Ullagón !

Often hav I seen the son's wife and the mother-in-law
Eying each other as a cat watches a mous;
Not thus was I and my Hundred Loves,
Our desires were in unison ;
Our bounty went together.
My sorrow that you hav died so soon,
Before your fame had gon through the length of Ireland ! Ullagón !

Wel I know the day I shal want you !
The day of the churning, to break and to beat (the cream) ;
The day of the flax, to prepare it speedily for me ;
The day of the cake, spreading and kneading it ;
The day of my clothing,† neatly bleaching it—
And the day of my death my hard sigh wil be for you ! Ullagón !

The Wake Games.

We come now to a very different phase of the wake ceremonies—the games indulged in by the younger portion of the company. Funeral games and feasts wer known to the Greeks and other nations of antiquity,

* Pronounced in Kerry :

Bŭ yăs lum a chăsaw' hu ŏgus bŭ yăs lum a thee hu,
Sbŭ yol-dhărag er wŏraga'n ree ghuith,
A dheel dhŏ khuij ăra 'sa glŏca dhŏ khyeesa.
Nur-a hănic thu a wŏla neer hrĕj ŏgus neer breen duith,
Ŏkh braeh er dhŏ lănaw' ŏgus ae khŏsa er a khyeen ghudh.

Iss minic'a khŭnicsa ban mic ŏgus mawhar caela
Mur vy'ŭkh coth ogus lŭkh er aeg a khyaela ;
Ne mur shoodh-a veensha ŏgus mŏ khyaedh-shorc.
Dhŏ veeh awr dhel dhŏ ghul a khaela ;
Dhŏ veeh awr nan-yakh ag imakhth a nacnakhth.
Shae mŏ khruathan er luaha aegish
Gŏ jaekh dhŏ huarasg er fŭdh na Haeran !

Iss mŏh a thaw's ŏgamsa an law hasthoe thu wimsha—
Law na cuiginya, brisha ŏgus dhŏ woala,
Law'n leen, a khuir a greeh gŏ lua ghum,
Law na bŏréna lăha ŏgus dhŏ huha,
Law mŏ khuij aedhig naetha huara,
Ŏgus law mŏ wawsh mŏ 'khawn crua hu.

† The day when the newly-woven linen is spread out to bleach.

among whom they partook of a religious character and wer intended to dispel the grief for the dead from the minds of the living. There is evidence that such was their original nature and intent in Ireland also, but Christianity and advancing civilization hav degraded the wake games, along with other lingering pagan ceremonies, from their former high estate, until they ar now little more than the rough sports of overgrown children. They hav degenerated greatly even during the last half century, and it might be safe to say that they wil soon disappear entirely had not the same thing been predicted by every writer on the subject for the last hundred years.

Lady Wilde gives an account of some games of a dramatic character which wer enacted at a wake in the south of Ireland some fifty years ago. Altho supposed to be related by an old man who was present on the occasion, it is evident that the language is not his own. It is also proper to state that the poetic fancy of the author is continually detecting a symbolic significance in things which appear very commonplace to ordinary mortals. As the games described seem to be entirely unknown to the present generation, we quote that portion in ful :

"When a great space was cleared in the centre of the barn, the first set of players entered. They wore masks and fantastic garments, and each carried a long spear and a bit of plaited straw on the arm for a shield. At once they began to build a fort, as it were, marking out the size with their spears, and using some rough play with the spectators. While thus engaged a band of enemies appeared, also masked and armed. And now a great fight began and many prisoners were taken ; but to save slaughter a horn was blown and a fight demanded between the two best champions of the hostile forces. Two of the finest young men were then selected and placed at opposite ends of the barn, when they ran a tilt against one another with their spears, uttering fierce, loud cries and making terrible demonstrations. At length one fell down as if mortally wounded ; then all the hooded women came in again and keened over him, a male voice at intervals reciting his deeds, while the pipers played martial tunes. But on its being suggested that perhaps he was not dead at all, an herb doctor was sent for to look at him ; and an aged man with flowing white beard was led in, carrying a huge bundle of herbs. With these he performed sundry strange incantations, until finally the dead man sat up and was carried off the field by his comrades with shouts of triumph. So ended the first play.

"Then supper was served and more whisky drunk, after which another play was acted of a different kind. A table was set in the middle of the barn, and two chairs, while all the people, about a hundred or more, gathered round in a circle. Then two men, dressed as judges, took their seats with guards beside them, and called on another man to come forth and address the people. On this a young man sprang on the table and poured forth an oration in Irish, full of the most grotesque fun and sharp allusions, at which the crowd roared with laughter. Then he gave out a

verse like a psalm in gibberish Irish and bade the people say it after him. It ran like this, being translated :

Yellow Macauly has come from Spain,
He brought sweet music out of a bag,
Singing *See-saw, Sulla Vick Dhau,*
*Sulla, Sulla Vick Dhau righ.**

"If any one failed to repeat this verse after him he was ordered to prison by the judges, and the guards seized him to cut off his head ; or if any one laughed the judge sentenced him, saying in Irish, 'Seize that man, he is a pagan ; he is mocking the Christian faith. Let him die !' "†

Another of these dramatic performances, which seems also to be unknown at present, is thus described by the same author : "The Hierophant (*sic*) or teacher of the games, orders all the men out of the room ; a young girl is then dressed with a hide thrown over her and horns on her head, to simulate a cow, while her maidens form a circle and slowly dance round her to music, on which a loud knocking is heard at the door. 'Who wants to enter?' asks the Hierophant. He is answered, 'The guards demand admittance for the bull who is without.' Admittance is refused, and the maidens and the cow affect great alarm. Still the knocking goes on, and finally the door is burst open and the bull enters. He is also robed with a hide and wears horns, and is surrounded by a band of young men as his guards. He endeavors to seize the cow, who is defended by her maidens, forming the dramatic incidents of the play. A general mock fight now takes place between the guards and the maidens, and the scene ends with uproarious hilarity and the capture of the cow."‡

The modern games ar generally simple tests of endurance or agility, rough practical jokes perpetrated upon innocent victims or courting games resembling "forfeits." It is a common thing for some activ young fellow to open the proceedings by jumping up, throwing off his coat and climbing hand over hand along the rafter to the highest point of the roof and down to the wall on the other side in the same way. This is at once accepted as a challenge by every athletic young man present and for a few minutes they ar swarming along the rafters like so many monkeys.

Then come tests of endurance, in which the young men of two parishes or townlands ar generally ranged against each other. In one of these known as *Bróigín* (Brogeen), "The Slipper," one man kneels down with his open hand held out in front of him, while another stands over him with a short piece of rope or a knotted handkerchief, which is sometimes dipd in water so as to giv a more stinging blow. Bracing himself firmly, he brings the rope down with all his force on the open palm of the kneeler, who endeavors to grasp it as it strikes him, and must endure the blows until he succeeds, when it is his turn to inflict the same punishment upon some one of the opposite party. This is the play describd by Carleton

* Properly (Genitive case), *Solomon, M'ic Dáib'i rig'*; " Solomon, son of King David."
† Lady Wilde, Ancient Legends of Ireland, i, 229–231, London, 1887.
‡ Idem, 233.

under the name of "Standing Brogue," in which one man stands up with his hands, locked together, hanging down in front of him, and trys to catch between them the brogue or slipper with which he is struck by the other.

Another game of the same character is calld in the west *Cloif air Bas* (*clif er bŭs*) or "Blow on the Hand" and is also described by Carleton,* as formerly playd in the north, under the name of *Hotloof*, which is probably derived from the Gaelic term. There ar several forms of the game. In one the victim leans over with his open hand, palm upward, resting behind him on his hip. One of the other side then steps up and strikes the open palm with his fist, sometimes with such force as to disable the sufferer for the rest of the night. Any flinching would bring disgrace upon the side to which the coward belongd, but the striker is at once challenged by some champion of the opposing party and must submit to the same infliction, which is given with all the force that can be put into the blow. No exhibition of il-temper is allowd and anyone who should get angry would hav to deal with the whole party. At many of these gatherings there ar persons regularly selected to preserv the peace.

In another form of the game the players stand in a line, those of opposing sides alternating, each one with his left arm in front of his face, and the open hand resting, palm out, over his right ear. The first then gives his neighbor a stinging slap on the open palm, sometimes with sufficient force to send him spinning into the middle of the room. Number two does the same for number three, and so on to the last, who wreaks his vengeance upon number one.

Another game, also calld Bróigín, is sometimes known in the east as "The Slipper" and is mentioned by Carleton under the name of "Sitting Brogue." In this, one man stands in the middle while the others sit in a circle around him and, keeping their hands behind them, or under their drawn-up knees, pass a shoe or slipper rapidly from one to another. While he endeavors to find which one has the shoe some one wil strike him with it from behind, but when he wheels quickly around he finds all holding up their hands innocently in front. He must continue his search until he hits upon the right one, who then takes his place in the ring. This game is described by Goldsmith in the Vicar of Wakefield as playd at a social gathering, and as the author was himself an Irishman it is probable that he first saw it enacted at an Irish wake. It is also known as *Haire-Haire* (*Horra-Horra*), from an exclamation used by the players to distract the attention of the one in the centre. Plays of this nature, together with the various forfeit games, ar engaged in by young men and girls alike. It is hardly necessary to state that men alone take part in the tests of endurance already described.

In another game, known in the west as *Fag'ailt Ceird* (*Fawlch Cierch*) or "Getting a Trade," one man personates a tailor, shoemaker or some other

* All the wake games described by Wm. Carleton ar mentiond in "Larry McFarland's Wake," in his Traits and Stories of the Irish Peasantry, i, London, 1853.

tradesman, and selects two others as assistants. The candidates for apprenticeship, who ar always sure to be persons unacquainted with the game, ar then sent out of the hous, the door being fastend after them. A rope is next thrown over a rafter near the door, and a running noose fixd at one end, while one of the assistants holds the other. The employer then opens the door on a crack and, putting his head out, announces to those outside that he is in want of an apprentice to learn the trade. It is always a point to keep the applicants outside until they ar tired waiting, and if it be a cold night in winter they ar generally glad to get back into the hous on any terms by the time the door is opend. A candidate steps up to offer his services and is allowd to squeez through the doorway, which is at once closed behind him. His employer then advances as if to shake hands; instead of which he slips the noose over the wrist of the apprentice, when one assistant, with a sudden haul on the other end of the rope, quickly puls the arm of the victim to a perpendicular above his head, while the other helper, grasping his free arm with one hand, pours a stream of cold water down the uplifted sleev on the other arm. In spite of his surprise at such treatment the victim is pretty sure to make no outcry which would giv the alarm to those outside, and he takes his place in a warm corner to look on with grim satisfaction as they enter one by one to receiv the same dose. They hav their revenge at the end, however, when the door is thrown open and the employer and his assistants run for their lives into the darkness over fields and ditches, pursued by the outraged apprentices, who hav ful permission to pound and pinch them to their heart's content if they can catch them.

In another game of this kind the employer asks each one what wages he requires and when payment must be made. The servant may demand, for instance, "Ten pounds, twice a year," that is, ten pounds in two half-yearly instalments. When all hav been hired they ar sent outside and admitted one at a time to receiv their pay. The two assistants then hold the hired man in a stooping position while the employer proceeds to pay him his wages by sticking him with a pin according to the number of instalments agreed upon. A light stick is sometimes used to drive home the pin, and if the victim be an unpopular character his salary is raisd with a surprising liberality.

Another game is calld *Cleas a T-soipín* (*clăs a thĕpeen*) or "Game of the Wisp." In this two young fellows assume the character of lovers, one being drest as a woman, while both ar fantastically deckd out with wisps of straw along their arms and about their heads so as to conceal the features. As soon as they enter the room the lover espies the girl and makes toward her, while she retreats to one of the benches occupied by the company. He follows and attempts to sit down beside her, when she pushes him away, and in the scuffle the occupants of the bench ar generally landed in a heap on the floor. She escapes to the other side of the room and the same scene is re-enacted. Throughout this rough courtship the presence of the company is totally ignored and they climb over benches

and overturn stools in apparent unconsciousness of the fact that these ar occupied. Finally some one produces a broom, which is laid upon the floor, when the lovers jump over it and ar then pronounced man and wife. This, by the way, is familiarly known as a tinker's wedding. The honeymoon lasts about two minutes, when there is a family quarrel, and the wife brings down the broom over the shoulders of her husband, who takes refuge behind one of the benches, followd by his enraged partner, who rains down blows alike on the just and on the unjust, so that there is a general scattering until she finally chases him out of the room.

In *Ceannach na G-caora* (*cănakh na gera*) or "The Purchase of the Sheep" the "sheep" sit down in a row on the floor, one behind another, each one with his feet projecting beyond the one in front, who holds them firmly against his side. The owner of the sheep then enters accompanied by the prospectiv buyer, who carrics a stout stick. The purchaser proceeds to examin the sheep to see if they ar sound, which he does by tapping them on the head with the stick and blowing into their eyes, while he judges of the quality of the wool by pulling out liberal handfuls of hair. Those who ar posted on the game ar let off easily, but the others, especially any who ar disliked by the crowd, pay dearly for the fun, while all the struggles of the victim ar ineffectual because his feet ar held by his neighbor. At last having bought the sheep the purchaser brands them by drawing a line of soot over their faces, but for fear that should rub off he puts his earmarks upon them by pinching their ears in an instrument of torture made by breaking the stick nearly in two in the middle until the two parts close back upon each other like a hinge. The buyer then discovers that he has not money enough and asks some one to "bail" him. Should any looker-on be so innocent as to volunteer his help, he is seizd and held while the creditor exacts payment with a stick or a pin according to the amount of the debt. Finally the victims ar releasd and chase their tormentors over the fields, as already described.

Another game, known in the east as "Priest of the Parish," is known also in the west under the Gaelic equivalent *Sagart a P'arráiste* (*Sŏgarth a Frawshcha*), but as the formula in both cases is in English, the game is probably of late introduction in the west and may be of foreign origin altogether. The "priest" sometimes puts on a wig or a gown of some kind to ad dignity to his appearance. Another of the players is calld "Man Jack," while the rest take such names as White Cap, Black Cap, Blue Cap, Cabbage Cap, and so on. On entering the room the priest stands before the players and recites the formula :

"I'm the priest of the parish,
That lost my 'sidherin'* cap—
Some say this and some say that,
But I say my Man Jack."

Man Jack instantly asks, "What, me, sir?"
"Yes, you, sir."

* Considering.

"You're a liar, sir."
"Who then, sir?"
"Black Cap, sir."
And unless Black Cap at once calls out "What me, sir?" and so on, he suffers the penalty, which is usually a daub of soot on his face or a smart slap on the cheek. This game is described also by Carleton. The marking with soot occurs in some Scandinavian children's games, and also among the Greenland Eskimo, who may have taken it from their Norse neighbors.*

In another game known in Galway as *Dam'sa na G-coinnínid'*, the "Dance of the Rabbits," the players hop about the room in a stooping position singing :

Dam'sa na g-coinnínid',
Gard'ad' a h-eorna,—
A coinnín is oige
B'ris sé a c'os.†

"The dance of the rabbits
In the garden of barley—
The youngest rabbit,
He broke his leg."

The one who first trips and falls is the unfortunate "youngest rabbit."

Lady Wilde mentions a play called *Hold the Light,* "where the passion of the Lord Christ is travestied with grotesque imitation" and another known as the *Building of the Ship,* in which she sees "a symbolic rite still older than Druidism and probably a remnant of the primitive Arkite worship." She goes on to say that "It was against these two plays that the anathemas of the Church were chiefly directed, in consequence of their gross immorality, and they have now entirely ceased to form any portion of the wake ceremonial of Ireland. Hindu priests would recognize some of the ceremonies as the same which are still practised in their own temples; and travelers have traced a similarity also in these ancient usages to the 'big canoe games' of the Mandan Indians."‡ With regard to the first mentiond play I know nothing. Of the other, known in Gaelic as *Gleus Loinge,* "Dressing of the Ship," or *Cuiread' Crann air a Long,*§ "Putting a Mast on the Ship," it may be briefly stated that the so-called symbolic rite is simply a coarse practical joke at the expense of some innocent victim, and so far is it from being extinct that my information concerning it was obtaind from a young man who witnesd its performance at a wake at about the very time the lines above quoted wer written and almost within sight of the author's mansion in Mayo.

There ar several marrying games known as *Marrying, Frimsy Framsy,* the *Tinker's Marriage,* etc. In each of these the master of ceremonies, who is usually fixed up to represent a priest, calls out from the company

* E. B. Tylor, Old Scandinavian Civilization among the Modern Esquimaux, Jour. Anth. Inst., xiii, 354, London, 1884.

† Pronounced, *Dhaw'sa na gŭneenee,*
Gŏru a h'yoerna,
A cŭneen iss oiga
Vrish shae a khus.

‡ Lady Wilde, Ancient Legends of Ireland, i, 232, London, 1887.

§ Pronounced, *Glaes Linga* and *Cŭru Crawn er a Lung.*

some young man or woman, who is told to choos a partner of the opposit sex. The person thus designated comes or is brought up to the first one calld out, when the priest recites a mock marriage service over the pair, after which the husband kisses his bride, in which he is followd by the minister. Another couple is then brought out in the same way, and so the game goes on. In one of these plays the question put to the first one calld, who is generally a girl, is, "Fair maid, Frimsy Framsy, who's your fancy?" In another the formula is, "Daughter, daughter, choos your partner."

The descriptions of the following games ar taken from Carleton's work already referd to, quotations being given without the dialect. In *Weds* or *Forfeits*, also called *Putting Round the Button*, the master of ceremonies receivs from each player some forfeit, a pocket knife, handkerchief or something of that kind. Each one stoops in turn while the leader holds a forfeit over his (or her) head and bids him name the penalty by which the owner may redeem the property. The owner is generally commanded to sing a song, to kis some boy or girl of the company, or perhaps to carry some old man three times around the room, and it is a great point in the game to compel a coquettish girl or a roguish young fellow to kis some toothless old man or withered-up grandmother in the company.

Another is calld *Horns* or *The Painter*. The players form a ring about the leader, who sits in the centre with his two forefingers extended upon his knees. He begins, "Horns, horns, cow horns!" and raises his fingers with a jerk high above his head. Every one in the room must instantly do the same, because the animal named has horns. He begins again, "Horns, horns, goat horns!" and up go all the fingers again, because a goat also has horns. He goes on, "Horns, horns, horse horns!" and raises his fingers as before, but wo to the unlucky one in the circle who lifts a forefinger, for a horse has no horns, and the penalty for his carelessness is a stroke of soot across his cheek. The game requires quickness of thought and action, and as may easily be seen it occasions much sport.

In *The Silly Old Man* the one who personates that character stands in the middle of the floor, while the others, boys and girls alternately, join hands in a circle about him and begin to sing:

Here's a silly old man that lies all alone,
That lies all alone, that lies all alone;
Here's a silly old man that lies all alone,
He wants a wife and he can get none.

The silly old man must then select a wife from one of the girls in the ring. The one chosen enters the circle along with him while the others sing:

Now, young couple, you're married together,
You're married together, you're married together,
You must obey your father and mother,
And love one another like sister and brother—
I pray, young couple, you'll kiss together.

And there is seldom any objection raisd in regard to this part of the

ceremony. It may be remarkd, in parenthesis, that, with an Irishman, none rhymes with alone, while again rhymes with remain.

The *White Cockade* brings up to memory one of the most dramatic events in the sad history of Ireland, when, after the fall of Limerick in 1691, its heroic defenders, abandond by the cowardly James II, and disappointed in their hopes of French assistance, spurnd the profferd service in the army of the conqueror, and almost the entire body of fourteen thousand of the flower of Irish manhood turnd their backs on their nativ land forever to follow the white cockade of the kings of France. The game is thus described by Carleton: "The man that leads the sports places them all on their seats—gets from some of the girls a white handkerchief, which he ties round his hat as you would tie a piece of mourning. He then walks round them two or three times, singing:

Will you list and come with me, fair maid?
Will you list and come with me, fair maid?
Will you list and come with me, fair maid?
And follow the lad with the white cockade?

When he sings this he takes off his hat and puts it on the head of the girl he likes best, who rises up and puts her arm round him, and then both go about in the same way, singing the same words. She then puts the hat on some young man, who gets up and goes round with them, singing as before. *He* next puts it on the girl *he* loves best, who, after singing and going round in the same manner, puts it on another, and *he* on *his* sweetheart, and so on. This is called the *White Cockade.* When it's all over, that is, when every young man has pitched upon the girl that he wishes to be his sweetheart they sit down and sing songs and court, as they did at the marrying."*

Investigation would probably show that some of these games wer brought over from the neighboring island by the Scotch and English settlers in the north. While the young folks ar indulging in such plays the older ones look on or pass the time in singing and telling stories. It was formerly considered an honor to be known as "a great hand at a wake," but the tendency of late years is to eliminate the more boisterous features and to confine the proceedings to the less noisy games and to story-telling. Of course the immediate friends of the deceasd do not join in the merriment, but they ar sometimes compeld to laugh in spite of themselvs, even through their tears, and, as before stated, the original purpose of funeral games seems to hav been to banish the grief of the survivors. All this does not argue an unfeeling nature. On the contrary, the sorrow is deep in their hearts, for Irish affection is strong and constant, and outlasts life itself, as is shown by the fact that second marriages ar universally abhord and almost unknown in Ireland.

No one should take a child in his arms after being at a wake, without

* Wm. Carleton, "Larry M'Farland's Wake," in Traits and Stories of the Irish Peasantry, i, 258–9, London, 1853.

first dipping his hands into holy water; neither should any one visit a sick person on coming from a wake.*

The Funeral Procession and Burial.

The wake generally continues until the morning of the third day, when the friends make the final preparations for the funeral. Until of late years the priest rarely attended the funeral or was present at the burial, but it was customary to celebrate a requiem mass, known as the "month's mind," at the hous of the deceasd one month after the death. Another, known as the "year's mind," was sometimes celebrated in the chapel on the first anniversary. It is a matter of congratulation if the funeral occur upon a Sunday, as that is the day upon which Christ ascended into heaven, and a shower is accepted as a sign that the fires of purgatory wil soon be quenchd for the soul. A saying, quoted by Napier, indicates the existence of a similar belief in Scotland.† On the other hand, it is unlucky to dig the grave on Monday, probably because the week would be unfortunate if begun in such a manner. The corpse is not put into the coffin until the procession is about to start, when the friends kiss the face for the last time and the lid is then fastend down, holy water being frequently sprinkled upon the coffin and attendants at the same time. In some parts the coffin is then brought out and placed on chairs outside the door, while the candles which hav been kept constantly burning about the corpse ar ranged on other chairs around the coffin and remain so until the procession begins to move. Should the corpse be that of husband or wife, the friends of either party frequently endeavor, as soon as the coffin has been taken out, to overturn the table or chairs upon which the body rested, in order that the next death may be among the relativs on the other side of the family, and this has sometimes occasiond a struggle even in the hous of death. Instances of this practice hav occurd in Washington. The lid must not be naild on the coffin of a new-born child, or, according to Lady Wilde, the mother who bore it will never hav another.

In districts where hearses hav not yet come into use the coffin is carried on a bier or on poles supported on the shoulders of four or six men. In some districts of Ulster, according to Carleton, the bearers formerly kept their arms hanging down in front, with the end of the pole resting upon the breast, until the churchyard was reachd, when the near relativs took the coffin upon the shoulders and made the circuit in the ordinary way.‡

It is always carried with the feet of the corpse to the front, and when set down at any time before or after reaching the churchyard the face is always toward the east. The bearers are relievd at intervals, all the men in attendance usually assisting by turns, as this is considerd a mark of

* Lady Wilde, Ancient Legends of Ireland, ii, 119, London, 1887.

† James Napier, Folk Lore or Superstitious Beliefs in the West of Scotland, 65, Paisley, 1879.

‡ Wm. Carleton, "The Party Fight and Funeral," in Traits and Stories of the Irish Peasantry, ii, 114 and 126, London, 1853.

respect to the dead. In Connemara the one who carries in front must, when relievd, take the place of the one behind him, and so on with the others, so that after the first start each man takes a turn at both front and back. In other parts of the country all the bearers ar relievd at the same time. Should a man fall while carrying the coffin he wil die within a year. If there be several ways of reaching the churchyard the longest road is alwavs chosen, as it is thought disrespectful to the dead to take a short cut. No one should look at the passing funeral from the threshold or through the window, but must stand in the middle of the room or outside the door until the procession has gon by. Any person violating this rule runs the risk of being the next corpse, as does also the one who should attempt to cross in front of the procession. It is also unlucky to let a corpse fall to the ground, or to meet a man on a white horse while going with a funeral. Any one coming from the opposit direction wil turn back and take *Trí Coismóid na Trócaire,** "three steps of mercy," with the funeral. In some parts it is customary, on coming to a crosroad, to halt for a moment and offer up a prayer for the deceasd, a practice which formerly existed also in Wales.† In some parts of Ulster it is customary to set the coffin down for a moment on coming to the boundary of the farm or garden plot upon which the dead man resided and here the caoine is raised again.

While the procession thus moves on toward the churchyard the women raise the caoine as already described. In the neighborhood of Ballybunion, Kerry, the men, instead of the women, raise the caoine while passing through a town, if the deceased was a man of special worth or promis. The reason given for this custom throws a curious light upon some other Irish beliefs: In the old days, when a young man fel in love with a girl whos parents objected to him he raisd his faction and carried her off by force without waiting to get her consent. On one occasion a young lover, with the help of his friends, had thus seized a girl about midnight and was bearing her away to his own district, holding her in front of him on the horse, "because he wouldn't trust her behind him." As they gallopd through a town she screamd out for help, when the men instantly raisd a caoine to drown her voice. The people who wer awakend by her screams heard the caoine and supposed that it was raisd over the corpse of some one who had died in a foreign land and was being taken home by "his good people"—the fairies attached to his family—to be buried in his ancestral cemetery. Through fear of the fairies they kept inside, so that the lover escaped with his bride, and the custom remains to this day to commemorate the event.

In Roscommon, Meath and the north-eastern counties, the caoine is never raisd for a child or young unmarried person. Instead of this the young friends of the deceasd, of the same sex, prepare what are calld "garlands," made by wrapping strips of scallopd white paper in a spira l

*Pronounced *Chree cushmaej na throcara.*

†Pennant, quoted in Jour. Auth. Soc., v, 425, London, 1876.

fashion around light sticks about a yard in length, the scallops pointing upward. These ar carried in procession on each side of the coffin, and ar afterwards driven into the earth above the newly-made grave so as to form two lines with the tops meeting in the centre. From a passage in Carleton* it would seem that in some parts of the north the garlands ar fixd upon hoops instead of upon straight sticks.

In several of the larger towns there was formerly an ancient stone cross standing in some prominent place, and around this every funeral procession passing through the town made a circuit. Most of these crosses hav long disappeard, but the old custom is stil kept up, the circuit being made around the former site. Thus at Navan, in Meath, the procession goes round the market-place, where it is probable a cross once stood,† and a corpse passing through Fethard, in Tipperary, "is always carried round the pump, because the old cross stood there in former times; and there is a certain gate of the same town—for a considerable part of the fortifications remain—through which a corpse is never carried, though in the direct course, because it was through that gate that Cromwell entered the town."‡

A curious observance in connection with the funeral of a murderd person is described by Carleton as formerly existing in the north of Ireland. The custom seems now to be extinct: "In Ireland when a murder is perpetrated, it is usual, as the funeral proceeds to the graveyard, to bring the corpse to the house of him who committed the crime, and lay it down at his door, while the relations of the deceased kneel down and with an appalling solemnity utter the deepest imprecations and invoke the justice of heaven on the head of the murderer. This, however, is usually omitted if the residence of the criminal be completely out of the line of the funeral, but if it be possible, by any circuit, to approach it, this dark ceremony is never omitted. In cases where the crime is doubtful, or unjustly imputed, those who are thus visited come out, and laying their right hand upon the coffin, protest their innocence of the blood of the deceased, calling God to witness the truth of their asseverations; but in cases where the crime is clearly proved against the murderer, the door is either closed, the ceremony repelled by violence, or the house abandoned by the inmates until the funeral passes."§ In the funeral described the mourners wore a profusion of crimson ribbons, to show that they bore the corpse of a murderd man, and on passing the spot where he receivd his death-blow the coffin was again laid down and the caoine raisd.

The spirit of the corpse last buried must *faireadʻ 'n teampoll* (*fŏroo'n*

*Wm. Carleton, "The Party Fight and Funeral," in Traits and Stories of the Irish Peasantry, ii, 128, London, 1853.

† W. R. Wilde, The Boyne and the Blackwater, 134, 2d ed., Dublin, 1850.

‡ Mr. and Mrs. S. C. Hall, Ireland Picturesquely Illustrated, i, 231, note, n. d., New York.

§ Wm. Carleton, "The Party Fight and Funeral," in Traits and Stories of the Irish Peasantry, ii, 145, London, 1853.

chompul), "watch the cemetery," and carry water in purgatory to the souls of all the others buried there until relievd by the soul of the one next interd. On this account, should two funerals be approaching at the same time, there is a contest for priority which becomes a serious matter if they meet at the churchyard. This has frequently led to disgraceful and even bloody scenes, which hav sometimes required the personal intervention of the clergy, especially in the old days of the factions. Instances hav occurd even within a few years past, but their recital would serv no useful purpose.

Just outside the wall of Kilranelagh churchyard, near Baltinglass, in Wexford, is a deep round wel, above which is a curvd recess in the wall. In this recess ar several ledges upon which ar a number of wooden cups. Every one interring in the churchyard the body of a child under five years of age provides one of these cups, in which the soul of the last corpse buried carries water from the wel to its predecessors in purgatory.* In Scotland there was the same struggle for precedence, but there, according to Napier, it was the duty of the one last buried to see that no suicide or unbaptized child was interd in consecrated ground.†

On entering the churchyard the procession goes three times around it on the inside following the course of the sun—a custom also observd in Scotland—while the people recite in a low voice the prayers for the dead. In some districts the coffin is then brought directly to the spot where the grave is to be dug, but in the eastern counties it is generally laid down upon a flag or a fragment from the old ruins. In making the circuit in an ancient churchyard at Slane, in Meath, the coffin is always set down for a few moments at a curious old tomb, locally known as a "pagan's grave," having two gable-shaped flagstones sunk in the earth about six feet apart, and groovd, evidently to receiv the stones which once formd the roof.‡ While the coffin is resting on the flag the nearest friends dig the grave. In accordance with the usages of the Catholic church the bodies of unbaptized children, suicides and those who have died intoxicated or without fulfilling their religious obligations, ar never buried in consecrated ground, but ar deposited in unblest earth adjoining the north wall of the cemetery, this part being known as "the wrong side of the churchyard." In the west and south there ar many small cemeteries, called *Cillín* (*Kil-yeen*), exclusively devoted to children. When a Catholic is buried in a Protestant cemetery, as sometimes happens in the north, a portion of clay is first consecrated by the priest and sprinkled over the coffin in the grave. According to Carleton, the priest in the same district would also throw the first three shovelfuls of earth upon the coffin

* Patrick Kennedy, Legendary Fictions of the Irish Celts, 187, London, 1866.

† James Napier, Folk Lore or Superstitious Beliefs in the West of Scotland, 63, Paisley, 1879.

‡ This tomb is mentioned by W. R. Wilde, The Boyne and the Blackwater, 182, 2d ed , Dublin, 1850; and by A. L. Lewis, Notes on Some Irish Antiquities, in Jour. Anth. Inst , ix, 141, London, 1880.

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in the name of the Trinity.* In the west, according to Lady Wilde, when the grave is dug a cross is made of two spades and the coffin is carried round it three times before being placed in the grave, after which the people kneel and recite the prayers for the dead.† The bodies of those lately buried turn over in their coffins when a suicide is deposited among them. So strong is the feeling in regard to self-destruction that in the rare instances where suicide has occurd the neighboring cemeteries hav sometimes been guarded for days by parties determind to prevent the burial of the body near their departed kindred. The same watch is also kept up when there is reason to fear grave robbers. Should a pregnant woman stumble in the churchyard, the child wil hav crooked legs. It is also unlucky for a man to stumble at the grave, and if he should touch the clay in his fall he will die before the end of the year. Should a woman tred upon a grave she must instantly kneel down and make the sign of the cross three times upon the sole of her shoe; otherwise her next child wil hav a club foot.‡

In digging the grave it is customary to cross the spade and shovel above the coffin in the hole, a practice founded on the following old legend: Saint Patrick's servant had once gon a long distance from the hous in search of firewood, and being delayd in consequence, was in great trouble, when he was approachd by a stranger who askd him what was the matter. The servant replied that he was in trouble because he was a long way from home and could not get back in time to prepare his master's supper. "What wil you giv me to bring you home before he'l expect you?" asked the stranger. "I wil giv anything you ask," said the poor servant, and with that the stranger, who was the devil himself, took him up in the air and in a moment set him down at the door long before the saint could get home. "Now," says the devil, "come back on such a day, at a certain hour, to the spot where you met me, and I'l take *you* for myself." So when Saint Patrick returnd from his prayers he found his servant crying and groaning in worse trouble than ever. "What's on you?" says the saint. "O," says the servant, "I sold myself to the devil in order to hav your supper hot and warm for you when you'd be coming in, and now on such a day and at such an hour I must go back to where I met him and he'l be there to take me off with him." "Never mind," says Saint Patrick, "but do as I say." So on the day appointed the servant was at the place by daylight and dug a grave at the spot. Then he stretched himself out in the grave and crossd the spade and shovel above him. At the hour agreed upon the devil appeard and when he saw the man lying in the grave he told him to come up out of that. "Come yourself and take me," says the servant; but the devil couldn't come near the cross, and after waiting until his hour was up he had to go away without the

* William Carleton, The Party Fight and Funeral, in Traits and Stories of the Irish Peasantry, ii, 127, London, 1853.

† Lady Wilde, Ancient Legends of Ireland, i, 155, London, 1887.

‡ Idem ii, 104,

man. From that day to this the practice is never omitted, because the devil cannot come near the corpse which has a cross over it.

Family Burial—Sacred Churchyards and Charms.

It is the universal custom to bury all the members of a family not simply in the same ancestral cemetery, but in the same grave, the last body being put down on top of those preceding it. Of course in time the grave becomes so fild up that each new interment disturbs the bones of those buried long before, where the coffins hav decayd. When the bones ar thus thrown up by the spade, the smaller ones ar carefully put back, while the larger ones, as the skul and thigh bones, ar pickd out from the heap and piled within or about the ancient church attachd to the cemetery. Every old abbey ruin in Ireland is fild with piles of bleaching skuls which hav accumulated in this way. Some years ago the proprietor of the estate on which ar situated the ruins of Mucross abbey at Killarney had a large pit dug, in which he buried all the ghastly remains scatterd about the place. The work occupied four men during five weeks, between seven and eight hundred cart loads being taken away.* Such a practice would breed contagion in almost any country but Ireland, where the constant sea breez carries off every pestilential vapor. Strange as the custom may seem, it has its origin in the strong ties of family affection, and bids fair to liv after the cacine and the wake ar forgotten. In one instance, in Meath, a woman, at her own request, was buried with her parents at Clady instead of with her husband at Kilcairn, because so many of his relativs wer buried in the same grave with him that "she was afraid her bones would not touch his." I hav been informd by an eye-witness of a case, occurring during a fever epidemic, in which nine coffins, lying three abreast, wer placed in the same grave. The same feeling actuated the Choctaws and kindred tribes, who formerly "reckoned it irreligious to mix the bones of a relation with those of a stranger, as bone of bone, and flesh of the same flesh, should be always joined together."† There is a prevalent belief that the bones thus taken up would not remain under ground if reinterd. In Connemara, when one coffin is put down upon another, a small hole is always broken in the lid of the lower coffin. The reason given is that if this wer not done there would soon be another death in the same family, but the original purpose was probably to leav a door through which the soul might pass in and out. This idea is also quite common in other parts of the world, and in the stone tombs of the Kassia hills, in India, the entrance slab is perforated with a round hole, apparently for the same purpose.‡ Throughout Ireland it is customary to use fragments from the old ruins in place of tombstones.

* Mr. and Mrs. S. C. Hall, Ireland Picturesquely Illustrated, i, 221, note, n. d., New York, R. Worthington, importer.

† James Adair, Hist. Am. Inds., 184, 1775.

‡ A. W. Buckland, Cornish and Irish Prehistoric Monuments, Jour. Anth. Inst , ix, 155, London, 1880.

The people hav a strong attachment to family cemeteries, and a horror of burial at the hands of the stranger. The sustaining hope of the poor man in his affliction, and the constant wish of the emigrant in his exile, is that he may die at home and lay his bones among his own people. The friends always try to carry out the wishes of the deceasd in this regard whenever possible, even though the cemetery designated should be at a considerable distance from the place of his death. There ar several curious beliefs on this subject, and stories ar told of persons who, having died in foreign lands, wer brought home for burial by the fairies attachd to the family. Should a corpse be buried with those of another family, the souls wil quarrel—a belief which seems to hav been held also by the Indian tribes of the Gulf States*—and if the cemetery be not selected in accordance with the wishes of the deceasd, the corpse wil take up its coffin and remove to another. There is also an idea, which is brought out in several old stories, that the soul of an unburied corpse must wander about and find no rest until the day of judgment.

The Kerry fishermen of Ballyheigh hav a legend of a ruind church which is sometimes visible below the waters of the bay. It marks the site of the ancient cemetery of the Cantillons, which was overwhelmd years ago by an encroachment of the sea. From that time, whenever a death occurd in the family, the body, in its coffin, was brought down to the seashore at night and left where the tide could reach it. In the morning it had disappeard, and it was known that the fairies had taken it away for burial in the churchyard under the sea. The spel was finally broken through the curiosity of a man who attempted to watch the spirits while at work. As soon as they discoverd him they abandond the coffin and disappeard forever.†

There ar several ancient cemeteries which ar regarded as peculiarly sacred, and to which the dead ar sometimes brought from long distances for interment. Chief among these ar Saint Kevin's cemetery at Glendalough, in Wicklow. It is said that owing to the prayers of the saint, any one buried here is sure to be saved at the day of judgment. Another is at the ruins of Saint Senan's church on Holy island, near the mouth of the Shannon, where, according to popular belief,

> No hel wil after death torment
> *True Christians* who ar buried in't.

It is accounted a sacrilege to disturb or pluck up any plants growing in a churchyard, and as a consequence the cemeteries ar overgrown with grass and weeds, excepting in the cities, where modern ideas ar bringing about a change. In the middle of a fertil field near Duncannon fort, in Wexford, is a small area overgrown with briers and furz, which has lain thus undisturbd for centuries, from a tradition—which seems to refer to a siege of the fort by Cromwell's forces in 1649—that here were buried

*James Adair, Hist. Am. Inds., 183, 1775.
†Legends and Fairy Tales of Ireland, 282, Haverty, publisher, New York, 1882.

the dead in some ancient battle.* On the hil of Tara, in Meath, is a tall pillar stone which marks the graves of the insurgents who fell there in 1798. The grass above these "croppies' graves" is peculiar in being green upon one side of the blade and red upon the other, owing, as the people firmly believ, to its springing from the blood of the croppies.

Near Templeshambo, in Wexford, is an old cemetery concerning which a curious legend is given by Kennedy. A monstrous serpent was desolating the country, but was finally slain by a young champion, who determind to show his gratitude by building a church. He prayd for some sign to direct him where to build it, and the next day he saw two ducks flying through the air, and followd them until they came to Templeshambo. "There they lighted, the drake on the near side of the stream, and the duck on the far one. So he built a monastery on the one side and a nunnery on the other, and even when there wasn't a stick nor a stone of either of them left, there was not a woman buried on one side, nor a man on the other, till the devil bewitched the people of Ballinlugg to bury Blue Cap on the men's side.' Blue Cap was the nickname for a woman of the imported Palatine settlers. The people resented this violation of an old custom so much that they raisd the coffin at night and set it up against the church door. After two reinterments the Palatines buried her on the other side of the stream, and there she was allowd to rest.†

There ar a number of cures and charms in connection with cemeteries and the dead which merit some notice in this connection. The same importance is attachd to the relics of saints and other holy persons that is common all over Europe and the east. The most noted of these was probably the *Fiac'ail Padruig* (*Feekhal Fŏrig*), or tooth of Saint Patrick, which was formerly preservd at the abbey of Cong, in Mayo, and was held in great repute in the cure of various diseases. The clay from certain venerated graves, as those of Saint Patrick at Downpatrick, in Down, and of Saint Declan at Ardmore, in Waterford, is also regarded as efficacious in curing disease, and as a protection against fire and evil spirits. For this purpose it is kept in houses, and put into medicine or boild with milk and drank, and is frequently carried as a safeguard by emigrants coming to America. At the ruins of Monasterboice, in Louth, the moss from one of the old crosses is held to be a cure for the chin cough (hooping cough) when gatherd by sinless hands, for which reason a child is generally sent to procure it.‡ The dead hand—or in some cases a skeleton hand—is in Ireland, as in Britain and on the continent, considered invaluable in the cure of disease by stroking in gathering butter in the

*Mr. and Mrs. S. C. Hall, Ireland Picturesquely Illustrated, ii, 143, note, n. d., New York, R. Worthington, importer.

†Patrick Kennedy, Legendary Fictions of the Irish Celts, 246 and note 351, London 1866.

‡Mr. and Mrs. S. C. Hall, Ireland Picturesquely Illustrated, ii, 419, note, n. d., New York, R. Worthington, importer.

churn and in preserving the cream from witches, and has also been used by burglars in connection with a candle as the "hand of glory." A piece of the linen sheet used in laying out the corpse wil cure a headache or swelling when tied around the affected part, while the wake candles ar esteemd for curing burns, and ar also used to singe the hair from the udder of a cow before milking her for the first time after calving. Another old belief, found also in England and Scotland, is that blood wil gush from the mouth and nose of the corpse of a murderd person when touchd by the murderer, either with his hand or with a rod. Suspected persons hav been subjected to this ordeal within recent years, and in some districts of the west it is even stil regarded as a regular legal procedure. The rod must never be cut from a holly tree, as in that case the blood would gush forth even tho the holder wer innocent. According to Lady Wilde, a seeming corpse, if not quite dead, wil utter a loud cry if touchd by the hand of :he nearest relativ.* On the spot where a corpse has lain a peculiar grass known as *Feur Gortac* (*faer gurthakh*), or "hungry grass," springs up, and any one stepping upon this grass will be seizd with such a sudden feeling of weakness and hunger that he wil be unable to leav the spot without help. An oaten cake or some oatmeal carried in the pocket counteracts the evil influence. By some persons, however, a fairy origin is ascribed to this grass.

Leachta—The Future Life.

Rude stone heaps or *Leachta* (*l'yŏkhtha*), erected in memory of the dead, ar found in Ireland as wel as in almost every other part of the globe, this form of monument being at once the most ancient and universal, from the fact that it is the most simple in construction, while the necessary materials ar almost always at hand. The leachta ar most numerous in the extreme west and south, where they ar stil built, but ar more or les common all over the island. They ar not tombs, but simple memorials of the dead, and ar known by the names of the persons whom they commemorate. I hav been informd that in Connemara the leachta sometimes cover actual graves ; but, if so, this is not in accordance with the general custom within the Christian period. They ar frequently, and perhaps usually, built in memory of some one who has met with a violent death, by murder or accident, in which case the monument is erected upon the site of the tragedy. They ar also erected by the nearest friends of the deceasd wherever the coffin is set down for a moment while on its way to the churchyard, the spot chosen being usually at the meeting of two roads. It is probable also that they ar sometimes intended to commemorate persons lost at sea, whose bodies cannot be recoverd for burial. The leacht is usually a simple heap of stones of convenient size carelessly thrown together, but in some cases the stones of the original structure ar selected and piled up with some degree of care, and brightend up from time to time with a coat of whitewash, and the whole is surmounted by a cross.

* Lady Wilde, Ancient Legends of Ireland, i, 154, London, 1887.

Every one passing that way throws another stone upon the heap and recites a short prayer at the same time for the soul of the deceasd, but in those cases where the monument commemorates the death of a man regarded as an enemy of the people there is reason to believ that the prayer is omitted. The idea of thus inviting the prayers of the traveler for one who has met with a sudden death is in entire accord with the character of the people, who regard it as a great misfortune to die without some previous time for preparation. When a funeral procession passes one of these piles it is customary to halt and lay the coffin down for a moment, while all the people, standing with uncoverd heads, recite a short prayer for the soul of the corpse, after which the coffin is again taken up and the procession moves on. The custom of building leachta is now perhaps extinct in the east, but existed down to a recent period. Thirty years ago there was a cross on the road between Navan and Donaghmore, in Meath, at the base of which was a large heap of stones, to which every passer-by added another. According to Kennedy, Kilranelagh churchyard east of Baltinglass, in Wexford, is situated on the crest of a hill and surrounded by a circular wall formd of loose stones. "Every man attending a funeral brings a stone picked up on its way, and throws it on the circular fence, and so the mighty ring has grown."*

From an old Kerry man was obtaind the history of one of these monuments, known as Leacht-Conway, near Ballybunion, which had been built within his recollection. It is a good illustration of the manner in which such memorials originate. Conway was a tithe-server for a minister of the Church of England, and was consequently much disliked by the people, who found it hard enough to pay an exorbitant rent without giving a tenth part of their produce toward the support of a foreign church. He had been several times warnd to giv up the business, but paid no attention, until at last the people became restless under his exactions. He calld one evening at the hous of a man known to the narrator, and was told that it would not be safe for him to go home that night and urged to stay until morning. He refused to stop, and started home, but had hardly gone a mile from the hous when he was waylaid and kild and his dead body was found in the road next morning. The people raisd a heap of stones on the spot, and for many years every one passing that way added another stone, until the pile might make ten cart loads. Most of the stones wer small, but some wer as large as could wel be carried. The leacht stil remains, but the traveler seldom throws a stone upon it in these later days. When askd if every one who threw a stone offerd up a prayer for the soul of Conway, the old man replied: "I'm afraid there wasn't much praying for him, becaus the people that prayd didn't like him, for he was an enemy to the poor."

Along the road just outside of Cong, in southern Mayo, there ar several hundred of these rude monuments, the unusual number here being due to the fact that this town was formerly held in peculiar veneration on ac-

* Patrick Kennedy, Legendary Fictions of the Irish Celts, 187, London, 1866.

count of the presence of a celebrated monastery to which bodies wer brought for burial from all parts of Ireland. Many of them ar built with more than the usual care, and ar thus described by observers: "Upon death occurring the primitive tumulus is built—if that may be called building which consists in placing a few large stones upon a spot previously unoccupied. Each relative of the dead adds to the heap, and in time it becomes a 'mountain' of tolerable size. Each family knows its own particular monument; and a member of, or a descendant from it, prays and leaves his offering only at that especial one. * * * In each of them we observed a small hollow, which the peasants call 'a window;' most of these were full of pebbles, and upon inquiry we learned that when one of the race to whom the deceased belongs kneels by the side of this record to his memory and offers up a prayer for the repose of his soul, it is customary to fling a little stone into this 'cupbord,' the belief being that gradually as it fills, so gradually the soul is relieved of punishment in purgatory; when completely full the soul has entered paradise."*

In regard to the future life there ar a number of interesting beliefs, many of which hav come down from Druidic times. It is held that the souls of those whose sins wil not allow them to enter heaven at once after death ar frequently condemd to spend their purgatory on this earth, generally invisibly, but sometimes in animal forms, and in this state to endure all the miseries of cold and hunger, weariness and thirst, that attach to mortal life. A white or spotted butterfly is held sacred as the embodiment of one of these spirits and is never intentionally injured. The same belief exists in China.† The spots indicate the number of sins yet to be atoned for, while the white butterfly is the purified soul on its way to paradise. For this reason a butterfly hovering about a sick-room is regarded as an omen of death, and should one alight on a corpse it is known to be the liberated soul of the dead man, and the duration of his purgatory is estimated from the number of spots on the wings of the insect. On the west coast seals ar held to be the embodied souls of the dead, and their plaintiv cries ar wails of sorrow in their misery. They ar never molested by the fishermen, who believ that swift punishment would follow any attempt to harm one. According to Hall, they ar the embodied spirits of those who perishd in the Deluge.‡

No one who dies in debt, or with a vow unfulfild, or in possession of stolen property, can enter heaven until full satisfaction has been made, either by the soul in purgatory or by the friends upon earth. Stories ar told of persons who hav died owing small sums, and whose spirits hav appeard soon after to their surviving relativs to ask them to pay the amount of the debt. Persons often vow to make a pilgrimage, or "go a

‡ Mr. and Mrs. S. C. Hall, Ireland Picturesquely Illustrated, iii, 376-7, New York, n. d., R. Worthington, importer.

† Chinese Superstitions, Popular Science Monthly, xxxii, 797, New York, April, 1888.

‡ Mr. and Mrs. S. C. Hall, Ireland Picturesquely Illustrated, iii, 408, n. d., New York, R. Worthington, importer.

round," to some holy place in gratitude for recovery from sickness or for some other reason, and should death prevent the performance of the engagement, some near relativ of the deceasd wil undertake its fulfilment, that the soul may not suffer on account of the unredeemd promis. Stolen property, no matter how trifling in value, also blocks up the way to paradise. They tel a story in Galway of a young man who appeard to his mother soon after death and told her that the only thing that was keeping him out of heaven was "the ful of a stocking of oats" which he had stolen and desired her to return in his name. It is especially unfortunate to die without having returnd borrowd salt, as the soul wil be loaded down in purgatory with a hundred times the weight of the amount borrowd until atonement has been made. On this account salt lent to a neighbor is generally considerd as a free gift which need not be repaid, the giver saying, "I won't lend it to you, but if I run short I'l come to you for some." When it is considerd as lent, however, the loan must be repaid with a greater quantity to make sure.

The dead often mingle unseen with their former friends, watching over them and taking note of their actions. In general ghosts ar regarded with dread, but when the spirit is supposd to be that of some dear friend or of some sufferer in purgatory the feeling is one of love and pity. The lights sometimes seen at night on the surface of the ocean along the west coast ar the spirits of the dead moving about, and the howling of the blast on a stormy night is the wailing of the suffering souls wandering to and fro in search of shelter. On such nights the children ar told to go to bed and make room for them to come in, while the parents sweep the floor and arrange seats near the fire for the accommodation of the unseen visitors. On November night, or Hallow E'en, the dead all rise from their graves and revisit their former haunts, and on this night the houses ar set in order and food and water left so that the spirits can help themselvs and be merry until daylight reddens in the east. Should any one *feel* the presence of a ghost and call it by its ful name it wil be obliged to make itself visible. One must not turn round at night when he hears footsteps following him, as the sound may be caused by a ghost, whose glance would be fatal. Neither must one turn back on seeing a ghost, or try to avoid it, but go directly up to it and ask it in the name of the Trinity, "Who ar you and what do you want?" There is a long prayer known as the Passion Prayer, which releases a soul from purgatory every time it is recited on Saturday.

There is a general belief in the transmigration, not only of souls but also of bodies and inanimate objects. For this reason small articles ar sometimes buried with the corpse for its greater comfort in the other world, and the body which has been deprived of its proper adornment through the poverty or meanness of the relativs. wil suffer in the next world on account of the neglect. In Hall's Ireland is an account of a man who came into the shop of a merchant in Clonmel, in Tipperary, in order to get a suit of clothes for his father. The merchant told him that he

must bring his father with him to be measured, when the man replied that his father was dead and that he intended to wear the clothes himself. On being questiond he explaind that when his father died he could not afford to dres the corpse for the grave as he wishd, so he was now about to get a new suit and wear it in his father's name, and as it wore away upon himself it would go to clothe his father in the other world. On further inquiry the merchant was told by another man from the same district that this was "as true as the light."*

An intelligent gentleman from the city of Cork states that in a cabin on the outskirts of that city he once saw a corpse laid out with the feet incased in heavy hobnailed shoes. On asking the reason he was told by one of the attendants that this was done to protect the feet of the dead man when walking over the fires of purgatory.

The following story from Clare illustrates this belief in connection with fairy seizure, and is given just as it was told by a woman who knew the parties: There was a traveling woman (beggar) who used to stop at our hous near Milltown-malbay whenever she was in that part of the country. She would get up in the middle of the night and come back with her eyes blackend, and say she had been with the fairies and they had beaten and batterd her. There was a strong farmer near us named McMahon, and his son died and his wife sold his shoes to the servant boy. Some time after this the woman came into the neighborhood again, but she had a bad piece of news. She said she had seen the "good people" playing hurley at night and that Tom McMahon was with them, and his feet wer all cut and bleeding with the stones, because he was barefoot on account of his mother selling his shoes. When the mother heard of it she was in a great way, so she went to the woman and asked her what she should do to giv her son relief. The woman told her to get back the shoes again and to return the money she was paid for them, then to sprinkle them with holy water and to give them to some poor person "for the honor of God and the good of her son's soul." The mother went to the servant boy and got back the shoes and returnd him the money. Then she sprinkled them with holy water and gave them to him again. Some time after the woman came to her and told her she had seen her son again with the fairies, and this time he had on his shoes.

*Mr. and Mrs. S. C. Hall, Ireland Picturesquely Illustrated, iii, 254, note, n. d., New York, R. Worthington, importer.

Stated Meeting, October 5, 1888.

Present, 20 members.

President, Mr. FRALEY, in the Chair.

Mr. Alexander Biddle, a newly-elected member, was presented to the Chair and took his seat.

Correspondence was submitted as follows:

A letter from Prof. Alphonse Favre, Geneva, accepting membership.

A letter from Capt. R. S. Hays, New York, acknowledging receipt of diploma.

A circular from the Franklin Institute, Philadelphia, announcing "Awards for Meritorious Discoveries and Inventions."

A letter from Dr. D. G. Brinton, Philadelphia, accepting the appointment by the President to prepare an obituary notice of the late Philip H. Law.

A letter from Prof. J. P. Lesley, Philadelphia, accepting the appointment by the President to prepare an obituary notice of the late Henry Carvill Lewis.

Mr. Richard Vaux, at the request of the writer of the following letter, communicated it to the Society, with some prefatory remarks.

"*To the Honorable Frederick Fraley, President,*
and the Members of the American Philosophical Society:

"I herewith present to the American Philosophical Society the sum of Five Thousand Dollars as an endowment fund, to be by its direction invested, and the income thereof devoted to the payment for a prize for the best Treatise on the Science and Philosophy of Jurisprudence, or any subject included in that term.

"It is my wish that the rules regulating the management, by the American Philosophical Society, of *The Henry M. Phillips Prize Essay Fund*, which I hereby endow as a tribute to the memory of my brother, who was a member of the Society, shall be made by

the Society as in its best judgment is deemed proper and necessary.

"If I may be permitted to make a suggestion, it would be that this Endowment Fund and its purpose be entrusted to a special, permanent or standing committee of the Society, to perform such duties as the rules governing the committee may require.

"With great respect,

(Signed) "EMILY PHILLIPS.

"PHILADELPHIA, October 1, 1888."

Mr. Vaux moved that the gift be accepted, which motion was carried by an unanimous vote. Mr. Vaux then handed to the President the check of Miss Emily Phillips, to the order of the Society, for $5000, which the President accepted on behalf of the Society.

On motion of Mr. Vaux, it was unanimously resolved, "That the subject be referred to a special committee of five members, to be appointed by the President at his leisure, who should report to the Society such rules and regulations as are best fitted to carry out the intentions of the donor."*

Accessions to the Library were announced from the Bataviaasche Genootschap van Kunsten en Wetenschappen; Pulkova Observatorij; Physikalische Gesellschaft, Berlin; Gartenbauverein, Darmstadt; Naturforschende Gesellschaft, Freiberg, i. B.; Prof. G. D. E. Weyer, Kiel; Physikalisch-Oekonomische Gesellschaft, Königsberg; Naturwissenschaftlicher Verein, Regensburg; Mr. A. Wallis, Stockholm; Royal Meteorological, Zoölogical Societies, Meteorological Office, Society of Antiquaries, "Nature," London; Prof. C. Piazzi Smyth, Edinburgh; Royal Society of Canada, Mr. Henry Mott, Montreal; Geological and Natural History Survey of Canada, Ottawa; "American Journal of Science," New Haven; New York Shakespeare Society, "The Forum," "Literature," "The Academe," New

* Henry M. Phillips was born at Philadelphia, on June 30, 1811; was elected a member of the American Philosophical Society on January 20, 1871, and died on August 29, 1884. His obituary notice was read before the Society by Hon. Richard Vaux, on December 18, 1884 (Proc. xxii, 72).

York; Dr. D. Jayne & Son, Messrs. Henry Phillips, Jr., and Isaac Myer, Philadelphia; U.S. National Museum, U.S. Geological Survey, Surgeon-General's Office, "The American Monthly Microscopical Journal," Washington, D. C.; University of California, Sacramento.

A photograph was received from the Rev. Dr. George W. Anderson, Bryn Mawr, for the Society's album.

The Special Committee appointed to examine a paper for the Transactions, by Prof. J. C. Branner, entitled "*The Cretaceous and Tertiary Geology of the Sergipe-Alagôas Basin of Brazil,*" reported in favor of its publication, and, on motion, the committee was discharged and the paper ordered to be printed.

Mr. Patterson DuBois read, by appointment, an obituary notice of the late James C. Booth.

Dr. Daniel G. Brinton read a paper on "The Language of Palæolithic Man."

Pending nomination No. 1180 was withdrawn.

And the Society was adjourned by the President.

Stated Meeting, October 19, 1888.

Present, 15 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

A letter from Mr. J. Sergeant Price, Treasurer of the Society, acknowledging the receipt from the President of the check for $5000 given to the Society at its last meeting by Miss Emily Phillips.

The President communicated a copy of the letter sent by him to Miss Phillips acknowledging her gift.

A letter from the President of the Society stating that he had appointed as the Committee authorized by the Society at its last meeting to report to the Society rules and regulations

for the "Henry M. Phillips' Prize Essay Fund," the following members—Messrs. Richard Vaux, Chairman, Henry Phillips, Jr., William V. McKean, Furman Sheppard, and Joseph C. Fraley.

Accessions to the Library were reported from the Asiatic Society of Japan, Yokohama; Royal Society of Tasmania; Publishers of the "Naturwissenschaftliche Wochenschrift," Berlin; Mr. Leopold Einstein, Nürnberg; Société Fribourgeoise des Sciences Naturelles, Fribourg; Philological Society, Cambridge, Eng.; Mr. R. A. Macfie, Clinton, Scotland; Boston Society of Civil Engineers; Rev. Edward E. Hale, Roxbury; Board of Directors of City Trusts, American Academy of Music, Pennsylvania Historical Society, Messrs. Henry Phillips, Jr., L. Voission, Philadelphia; Pennsylvania Geological Survey, Harrisburg; University of Nebraska, Lincoln; Société "Alzate," Mexico.

A photograph was received for the Society's album from Prof. Dr. Friedrich Müller, Vienna.

Letters of envoy from the Physikalische Gesellschaft, Berlin; K. Sächsische Gesellschaft der Wissenschaften, Leipzig; Meteorological Office, London; U.S. Geological Survey, Washington, D. C.

Letters of acknowledgment for 126 and others, from the Institut Egyptien, Cairo (126, 127); Societas pro Fauna and Flora Fennica, Helsingfors (126); Imp. Academy of Sciences, St. Petersburg (126); Prof. Dr. Friedrich Müller, Vienna (126); Naturwissenschaften Verein, Regensburg (125); Académie R. Danoise des Sciences et des Lettres, Copenhagen (126); Académie R. des Sciences de Lisbonne (119, 120, 121, 122, 124, and Report on Volapük); Prof. J. D. Whitney, Cambridge, Mass. (126); Prof. J. W. Moore, Easton (126, 127); Smithsonian Institution, Washington, D. C. (two boxes of exchanges); Observatorio Meteorologico Central, Mexico (102, 103, 104, 106, 107, 108, 116, 125, 126); Dr. Jesus Sanchez, Mexico (126).

Letters of acknowledgment for 127 from the Comité Géologique de la Russe, Imp. Academy of Sciences, Russian Geographical Society, St. Petersburg; Dr. Matthæus Much, Vienna;

Berliner Gesellschaft für Anthropologie, Ethnologie und Urgeschichte, Physiologische Gesellschaft, K. P. Meteorologisches Institut, Berlin; Naturwissenschaftlicher Verein zu Bremen; K. Sächsischer Alterthumsverein, Verein für Erdkunde, Dresden; Naturforschende Gesellschaft in Emden; Oberhessische Gesellschaft für Natur und Heilkunde, Giessen; Prof. Japetus S. Steenstrup, Copenhagen; R. Accademia dei Lincei, Rome; Station Séricicole, Montpellier; Société de l'Histoire de France, Paris; Royal Dublin Society; Rev. Edward E. Hale, Roxbury, Mass.; Conn. Historical Society, Hartford; Prof. W. D. Whitney, New Haven; Dr. Charles B. Dudley, Altoona; Rev. Dr. Geo W. Anderson, Rosemont; Dr. Benjamin Sharp, Philadelphia.

A letter with change address from *Der Naturforscher* to Die Wissenschaftliche Wochenschrift, Berlin (N. W. 6), Preussen.

The Committee on Publication reported that it had examined the paper of Prof. Branner and was of the opinion that it should be published, which, on motion, was so ordered.

The Special Committee appointed to examine a paper for the Transactions by Dr. R. A. Hare, entitled "The Pathology, Clinical History and Diagnosis of Diseases of the Mediastinum other than those of the Heart and Aorta," reported that it was not desirable for publication, being too technical; and, on motion, the Committee was discharged and paper returned to the author.

Dr. D. G. Brinton read, by appointment, an obituary notice of the late Philip Howard Law.

Prof. Cope presented a paper by Charles R. Keyes (Burlington, Iowa), on "The Attachment of Platyceras to Pallio Crinoids and its Effects in Modifying the Form of the Shell."

A paper by Prof. Charles Sprague Sargent, Cambridge, Mass., entitled "The Diary of André Michaux in the United States and Canada, 1785–1796, with an Introduction and Notes," was presented through the Secretaries.

On motion, the paper was referred to a special Committee

of three members to be appointed by the President at his leisure, to examine and report thereon to the Society.

A paper by Mr. James Mooney (Washington, D. C.), entitled "The Funeral Customs of Ireland," was presented through the Secretaries.

The President reported that he had received and paid over to the Treasurer of the Society the sum of $132.44, quarterly interest on the Michaux Legacy, due October 1, 1888.

The President read a letter in reference to the collection of the same from Drexel, Harjes & Co., Paris, dated August 7, 1888, and the following resolution was unanimously adopted:

Resolved, That, as the President of the Society has requested to be relieved from the collection of the interest on the French Rentes constituting the Michaux Legacy, Messrs. Drexel, Harjes & Co.. of Paris, France, and Messrs. Drexel & Co., of Philadelphia, Pa., be and they are hereby requested and authorized to pay the said interest as it accrues and is collected by them to the Treasurer of the Society.

And the Society was adjourned by the President.

Stated Meeting, November 2, 1888.

Present, 7 members.

Vice-President, Dr. RUSCHENBERGER, in the Chair.

Correspondence was submitted as follows:

A letter from the K. Sächsischer Alterthumsverein zu Dresden, requesting Proceedings Vol. xx, No. 110.

A circular from Miss Marie A. Brown, requesting pecuniary aid, to enable her to investigate the manuscripts in the Vatican relating to the pre-Columbian discovery of America.

Acknowledgments for Transactions xvi, ii, from the Boston Public Library; Museum of Comparative Zoölogy, Cambridge; American Antiquarian Society, Worcester; Yale University, New Haven; State Library, Albany; Buffalo Li-

brary; New York Historical Society, Astor Library, New York; New Jersey Historical Society, Newark; Pennsylvania State Library, Harrisburg; Historical Society of Pennsylvania, Franklin Institute, The Athenæum, Philadelphia; U. S. Military Academy, West Point; The Smithsonian Institution, Washington, D. C.; State Historical Society of Wisconsin, Madison; University of California, Berkeley.

Acknowledgments for Proceedings (126) from the Central Physical Observatory, St. Petersburg; Chicago Historical Society.

Acknowledgments were received for Proceedings (127) from the Scientific Committee of the Navy, Comité Geologique de Russie, St. Petersburg; R. Zoölogical-Botanical Society, The Hague; K. K. Central-Anstalt für Meteorologie und Erdmagnetismus, Wien; Naturhistorischer Verein in Bonn; Prof. L. Rütimeyer, Basle; Prof. E. Renevier, Lausanne; R. Comitato Geologico Italia, Rome; R. Astronomical Observatory, Turin; Prof. Abel Hovelacque, Paris; American Statistical Association, Boston; Academy of Sciences, New York.

Accessions to the Library were reported from the Gesellschaft für Erdkunde, Berlin; Prof. Leopold Einstein, Nürnberg; Académie Royale de Belgique, Bruxelles; Prof. L. Rütimeyer, Basle, Switzerland; Royal Society, Meteorological Office, London; Royal Geological Society of Ireland, Royal Dublin Society, Dublin; Nova Scotian Institute of Natural Science, Halifax; Massachusetts Historical Society, Boston; American Chemical Society, New York; Mercantile Library, Editor of the "Medical and Surgical Reporter," Mr. Ch. P. Hayes, Mr. Thomas Hockley, Hon. Richard Vaux, Philadelphia; Prof. A. S. Packard, Providence; Historical Society, Chicago.

A communication was received from Dr. P. Steiner, Darmstadt, in reference to his lately invented language, "*Pasilingua.*"

A communication was presented from Dr. L. Einstein, Nürnberg, in reference to *La Linguo Internacia.*

The President reported that he had appointed as the Committee to examine the paper presented by Prof. C. S. Sargent

at the last meeting, Prof. J. T. Rothrock, Chairman, and Messrs. Thomas Meehan and Aubrey H. Smith.

The Committee appointed to examine Prof. Sargent's paper on the Diary of Andrè Michaux, reported it worthy of publication and suggested that it be issued in the Proceedings of the Society, which, on motion, was so ordered and the Committee was discharged.

The Committee on Henry M. Phillips' Prize Essay Fund reported progress and was continued.

The Secretaries were authorized to print Mr. James Mooney's paper in the Proceedings of the Society.

Mr. Henry Phillips, Jr., gave a short historical sketch of the founding and progress of the *Congo Free State*.

New nominations Nos. 1181 and 1182 were read.

And the Society was adjourned by the presiding member.

Stated Meeting, November 16, 1888.

Present, 16 members.

Mr. THOMAS H. DUDLEY in the Chair.

Correspondence was submitted as follows:

Letters of acknowledgment were received from the Musée d'Histoire Naturelle de Belgique, Bruxelles (126); Zoölogical Society, Amsterdam (127); Teyler Museum, Harlem (127); Maatschappij der Nederl. Letterkunde, Leiden (127); Prof. G. Sergi, Rome (127); Prof. James Geikie, Edinburgh (127); Dr. J. H. Packard, Philadelphia (127).

Letters of envoy were received from the Mining Department, Melbourne, Victoria; K. P. Akademie der Wissenschaften, Berlin; Senckenbergische Naturforschende Gesellschaft, Frankfurt a. M.; Sociedad Mexicana de Geografia y Estadistica, Mexico.

Circulars were received from the U. S. Commission to the Paris Universal Exposition of 1889.

Accessions to the Library were reported from the Depart-

ment of Mines, Melbourne; Comité Géologique, St. Petersburg; Sociétés Impériales des Naturalistes de Moscou et d'Odessa; Prof. G. Bauer, Agram; K. P. Akademie der Wissenschaften, Berlin; K. Sächs. Alterthums-Verein, Dresden; Senckenbergische Naturforschende Gesellschaft in Frankfurt-am-Main; Dr. Julius Platzmann, Leipzig; Musée Royale d'Histoire Naturelle de Belgique, Société R. Malacologique de Belgique, Observatoire R. de Bruxelles; Baron Selys de Longchamps, Liège; Prof. Guiseppe Menenghini, Pisa; Revue Retrospective, Paris; Canadian Institute, Toronto; Mr. Lorin Blodget, Prof. E. D. Cope, Gen. C. W. Darling, Utica; Col. J. P. Nicholson, Dr. Charles A. Oliver, Henry Phillips, Jr., Philadelphia; Wm. John Potts, Camden; Commissioners of Pensions and of Labor, Washington, D. C.; Sociedad Mexicana de Geografia y Estadistica, Mexico.

The Committee on the Henry M. Phillips' Prize Essay Fund reported progress and was continued.

The Minutes of the Board of Officers and Council were submitted.

Prof. John C. Branner presented through Dr. Brinton a paper entitled, "Notes on the Botocúdus and their Ornaments," accompanied by some plates which, on motion, the Secretaries were authorized to reproduce in the Proceedings.

Pending nominations Nos. 1181 and 1182 were read.

The Society then took up the consideration of the matters acted upon by the Council.

On motion of Dr. Ruschenberger, the Society approved of the recommendation of Council that Prof. J. T. Rothrock be authorized to permit abstracts of and illustrations for his lectures delivered under the auspices of the American Philosophical Society, to be published in "*Forest Leaves*," as requested, provided that no loss or expense shall be chargeable to the Society connected with such abstracts or illustrations.

The resolution of Council relative to the Michaux legacy was considered, and a discussion ensued in which Mr. Price explained the present status of the fund, and stated what had been done thereunder.

After which, on motion of Dr. D. G. Brinton, it was resolved to postpone all further consideration of the matter until the presence of the mover in Council.

The following resolution, recommended by Council, was then taken up:

"That Council recommends that all papers presented for publication by the Society must be complete and ready for the printer at that time when so presented, and that they shall not be *substantially* altered after such presentation without the express permission of the Society; and further, that no paper shall be received that is *not* complete."

The Treasurer spoke of the heavy bills for printing the Society's publications, of which a great proportion of the expense was incurred for authors' alterations.

Dr. Brinton offered the following addition to the motion as an amendment:

"And that all alterations, duly authorized by the Society, shall be printed at the expense of the author."

The resolution as amended was then unanimously adopted by the Society.

The Society then proceeded to consider the Library of the Society's being opened from 10 A.M. to 3 P.M. on such days as it is required to be open.

Prof. Snyder moved to refer the resolution and all the subject connected with it to the Committee on Library. Dr. Brinton moved to lay the whole matter on the table, which motion, being put to a vote, was adopted.

Dr. Brinton called to the attention of the Society the desirability of reproducing the MSS. of the Aztec tribute roll, owned by the Society, and moved that the Chair appoint a committee of three members to ascertain the cost of its reproduction and publication in the Transactions of the Society, accompanied by suitable letter-press.

The resolution being put to a vote was adopted, and the Chair appointed as such Committee, Messrs. Brinton, Phillips, and Morris.

And the Society was adjourned by the presiding member.

Stated Meeting, December 7, 1888.

Present, 19 members.

President, Mr. FRALEY, in the Chair.

Letters of envoy were received from the Mining Department, Melbourne; Musée Teyler, Harlem; Maatschappij der Nederlandsche Letterkunde, Leiden; Royal Observatory, Greenwich; Royal Statistical Society, London.

Letters of acknowledgment were received from the Geological Survey of India, Calcutta; K. K. Geologische Reichsanstalt, Drs. Aristides Brezina, Friederich Müller, Dionys Stür, Vienna; Dr. Julius Platzmann, Leipzig; Dr. Henri de Saussure, Geneva; K. Istituto Lombardo, Milan; Mr. A. Des Cloizeaux, Mr. Victor Duruy, Paris; Radcliffe Observatory, Oxford; Penzance Natural History and Antiquarian Society; Mr. Henry Reed (127), Dr. W. J. A. Bonwill (126), Philadelphia.

Letters of acknowledgment for diplomas were received from Prof. Dr. Conrad Leemans, Leiden; Prof. Dr. Adolph Bastian, Berlin; Dr. Julius Platzmann, Leipzig; Prof. Dr. A. Réville, Dr. Paul Topinard, Paris; Capt. Richard Somers Hayes, New York.

Accessions to the Library were announced from Mr. Julius Lott, Vienna; Mr. Henry Roller, Berlin; "Zoologischer Anzeiger," Leipzig; Dr. F. von Holtzendorff, Stuttgart; Musée Teyler, Harlem; Maatschappij van Nederlandsche Letterkunde, Leiden; Instituto y Observatorio de Marina, San Fernando (Spain); Sociedad de Geografia, Lisbon; Royal Observatory, Greenwich; Geological and Natural History Survey of Canada, Montreal; Museum of Comparative Zoölogy, Cambridge; Dr. J. S. Newberry, Capt. Jas. E. Cole, New York; Geological Survey of New Jersey, Trenton; University of Pennsylvania, Drs. Charles W. Dulles, Charles A. Oliver, Mr. Henry Phillips, Jr., Philadelphia; Department of State, Lieut. A. W. Greely, Washington; Observatorio Astronomico Nacional de Tacubaya; Free Public Library, San Francisco.

A letter, presented by the Treasurer, from Dr. R. P. Harris, resigning from the Society, was read, and, on motion, the resignation was accepted.

A letter was presented (dated Washington, November 27, 1888) from the Forestry Division, U. S. Department of Agriculture, in reference to an exhibit at the Paris Exhibition.

A letter was read (dated Washington, November 15, 1888) from Prof. Cleveland Abbé, asking for information relating to the life of the late Prof. James P. Espy.

Pending nominations Nos. 1181 and 1182 were read.

Mr. Price, from the Michaux Committee, presented the following report and resolution, which, on motion, the Society unanimously adopted:

To the American Philosophical Society:

The Michaux Committee respectfully reports that, at a meeting of the Committee, held on Friday, November 30, 1888, letters were received from Prof. J. T. Rothrock, stating that he had made preparations for the usual annual course of lectures to be delivered under the auspices of the American Philosophical Society. The subjects of the seven lectures for this year are:

1. Forest Regions of North America.
2. Fungal Foes of the Farmer.
3. Some Big Trees.
4. Home Plants and Home Health.
5. Trees in Literature and Mythology.
6. What Forestry is Practicable in Pennsylvania.
7. Evolution in Plants.

Four of these lectures will be illustrated by lantern slides from photographs taken by the lecturer under former resolutions of the Society. He proposes to deliver these lectures on Tuesday evenings in January and February, 1889, as follows: January 8, 15, 22, and 29, February 5, 12, and 19, and has suggested that they be given at the hall of the Franklin Institute, on Seventh street above Chestnut street, which can be obtained at a cost of five dollars a night, and where excellent and convenient arrangements can be made for the use of the lantern and the supply of gas under the direction of Mr. Frederick E. Ives.

The suggestion of Prof. Rothrock met with the full approval of the Committee, and it recommends the expenditure of two hundred and fifty-five dollars from the appropriation of the Michaux Fund as follows:

Seven lectures	$140 00
Use of hall for the course	35 00
Advertising	50 00
Printing tickets	10 00
Gas for lantern, etc.	20 00
	$255 00

Prof. Rothrock also presented to the Committee an application made to him by the Department of Agriculture, at Washington, asking for the use of part of the negatives in his possession, belonging to the Society, for the purpose of having enlarged positives made from them, to be exhibited at the Paris Exposition next year. Prof. Rothrock stated that the Chief of the Forestry Bureau had assured him that at the Exposition full credit would be given to the American Philosophical Society for furnishing these illustrations, and he also said that the enlarging would be done in this city and that the negatives during the process would be practically under his own observation. The Committee approved of the application, and it accordingly recommends the adoption of the following resolution :

Resolved, That the report of the Michaux Committee be approved, and that Prof. Rothrock be authorized to allow the Chief of the Forestry Bureau of the United States Government to have the use of the negatives in his possession, belonging to the Society, for the purpose of having enlarged prints made from the same at the expense of the Bureau, to constitute an exhibit of the American Philosophical Society at the Paris Exposition.

By order of the Committee,

J. SERGEANT PRICE, *Secretary.*

The Publication Committee reported that during the past year the Second Part of Volume XVI (New Series) Transactions had been issued by the Society, and that the Third Part had been begun.

The Treasurer presented his annual report, which was read and referred to the Committee on Finance.

The Committee on the Aztec MS. (Codex-Poinsett) reported progress, and was, on motion, continued.

The Committee on the Henry M. Phillips' Prize Fund Essay presented the following report:

The Committee appointed by the American Philosophical Society, held at Philadelphia for Promoting Useful Knowledge, to report to the Society such rules and regulations as are best fitted to carry out the intentions of the donor of the Henry M. Phillips' Prize Essay Fund, respectfully reports:

That it has met several times and has carefully considered th

matters referred to it. It has the honor to submit, for the approval of the Society, a draft of a preamble and regulations for the said Fund.

It is of the opinion and recommends that the first prize to be awarded by the Society shall be for the best Treatise on the History and Growth of the Philosophy of Jurisprudence, divided into Ancient, Mediæval and Modern Periods, presenting a complete conspectus of the literature, bibliography, and opinion pertaining to the subject.

It also recommends that the first prize to be awarded by the Society shall be the sum of one thousand dollars, lawful gold coin of the United States of America, and that all treatises in competition therefor shall be in the possession of the Society before the first day of January, 1893; this date being fixed upon to allow time sufficient for authors to gather proper material for their treatises.

The Committee recommends that all matters relating to the second and following prizes shall be relegated to the Standing Committee, to be hereafter appointed by the Society.

Your Committee would beg to offer the following resolution for the consideration of the Society:

Resolved, That this Society tenders its thanks to Miss Emily Phillips for her generous gift of five thousand dollars to found the Henry M. Phillips' Prize Essay Fund, which it has accepted with sincere satisfaction.

THE HENRY M. PHILLIPS' PRIZE ESSAY FUND.

Miss Emily Phillips, of Philadelphia, a sister of Hon. Henry M. Phillips, deceased, presented to the American Philosophical Society, held at Philadelphia for Promoting Useful Knowledge, on October 5, 1888, the sum of five thousand dollars for the establishment and endowment of a Prize Fund, in memory of her deceased brother, who was an honored member of the Society. The Society, at a stated meeting, held October 5, 1888, accepted the gift and agreed to make suitable rules and regulations to carry out the wishes of the donor, and to discharge the duties confided to it. In furtherance whereof, the following rules and regulations were adopted by the Society at a stated meeting held on the seventh day of December, A. D. 1888:

First. The Prize Endowment Fund shall be called the "Henry M. Phillips' Prize Essay Fund."

Second. The money constituting the Endowment Fund, *viz.*, five thousand dollars, shall be invested by the Society in such securities as may be recognized by the laws of Pennsylvania, as proper for the investment of trust funds, and the evidences of such investment shall be made in the name of the Society as Trustee of the Henry M. Phillips' Prize Essay Fund.

Third. The income arising from such investment shall be appropriated as follows:

(*a*) To making public advertisement of the prize and the sum or amount in United States gold coin, and the terms on which it shall be awarded.

(*b*) To the payment of such prize or prizes as may from time to time be awarded by the Society for the best essay of real merit on the Science and Philosophy of Jurisprudence, and to the preparation of the certificate to be granted to the author of any successful essay.

Fourth. Competitors for the prize shall affix to their essays some motto or name (not the proper name of the author, however), and when the essay is forwarded to the Society, it shall be accompanied by a sealed envelope containing within the proper name of the author, and, on the outside thereof, the motto or name adopted for the essay.

Fifth. At a stated meeting of the Society, in pursuance of the advertisement, all essays received up to that time, shall be referred to a Committee of Judges, to consist of five persons, who shall be selected by the Society from nomination of ten persons made by the Standing Committee on the Henry M. Phillips' Prize Essay Fund.

Seventh. All amounts of interest accruing and unexpended on each and every occasion on which no prize shall be awarded, shall be considered and taken as accretions to the principal of the said fund.

Eighth. All essays may be written in English, French, Dutch, Italian, Spanish, or Latin; but, if in any language except English, must be accompanied by an English translation of the same.

Ninth. No treatise or essay shall be entitled to compete for the prize that has been already published or printed, or for which the author has received already any prize, or profit, or honor, of any nature whatsoever.

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Tenth. All essays must be clearly and legibly written on only one side of the paper.

Eleventh. The literary property of such essays shall be in their authors, subject to the right of the Society to publish the crowned essays in its Transactions or Proceedings.

Twelfth. A Standing Committee, to consist of six members and the Treasurer of the Society, shall be appointed by the President, which shall continue in office during the pleasure of the Society, and any vacancies that may occur in said Committee shall be filled by new appointment by the President.

Thirteenth. The said Committee shall have charge of all matters connected with the management of this endowment and the investment of the same, and shall make such general rules for publishing the terms upon which said prize shall be competed for, and the amount of the said prize, and, if it shall deem it expedient, designate the subjects for competing essays. It shall report annually to the Society, on the first Friday in December, all its transactions, with an account of the investment of the Prize Fund, and of the income and expenditures thereof.

All of which is respectfully submitted,

RICHARD VAUX,
HENRY PHILLIPS, JR.,
WILLIAM V. MCKEAN,
FURMAN SHEPPARD,
JOSEPH C. FRALEY.

Philadelphia, November 20, 1888.

On motion of Mr. Vaux, the report, with all its resolutions, was unanimously adopted.

On motion of Mr. Dudley, the Secretaries were directed to have a sufficient number of copies of the same printed separately for general distribution.

The Committee on an International Language presented the following report:

Supplementary Report of the Committee Appointed to Consider an International Language.

Your Committee desires to present a Report of Progress at this time with reference to its former observations on the adoption of an International Language and the success of the proposal of the Society to call an International Congress to consider this project.

We may begin by saying that the general subject has visibly increased in importance in the minds of the public. A number of new plans to achieve the end in view have been suggested, and modifications of those existing have been offered. A reference to some of these may not be out of place, as proving that the subject in which the Society has interested itself is not a sterile or insignificant one.

Two of these works are by American authors, and advocate the adoption as a universal language of English, more or less modified. One is entitled "World-English, the Universal Language," by Prof. Alexander Melville Bell, author of "Visible Speech," etc. His claim is that English in its present grammatic form is simple and clear, and in all respects adapted for general adoption but for its incongruous orthography. This he proposes to remedy by a new phonetic alphabet, which he presents and illustrates. It contains forty-two letters, many of them new in form, others old in form, but distinguished by diacritical marks. The accent on the vowels is represented to the eye, and the print is consequently highly complex.

The numerous difficulties of English grammar and lexicography are of course not in the least abated by the phonetic system of Prof. Bell. What these difficulties are has been urged with much earnestness by the second writer to whom we refer, Mr. Elias Molee, of Dakota, in his work, "Plea for an American Language or Germanic English." After setting forth the insuperable obstacles to the general acceptation of English, he proposes to remove them by introducing a series of modifications into its alphabet, its grammar and its lexicon. Various new letters and a quantity of diacritical signs are called in to represent the sounds. The inflectional grammatical system is selected, and the additions to the vocabulary are chiefly from the Teutonic languages. It is obvious, from what we have previously said on the evolution of the Aryan tongues, that this form of grammar is a recurrence to obsolescent principles, and the preference awarded to the Teutonic group is inconsistent with the broad principles on which a modern universal language should be founded.

European writers have also not been without their suggestions towards the same end. One of the most noteworthy, if not for its practicability, at least for its scholarly presentation, is the work of Prof. Dr. Aug. Boltz, of Darmstadt, entitled *Hellenisch die Allgemeine Gelehrtensprache der Zukunft*, in which the author presents for adoption a modified form of the classic Greek. This, he thinks, has claims superior to any modern language, and advantages beyond any new creation in language which could be devised. It is not at all likely that he will count many disciples, the Greek alphabet alone being sufficient to frighten most men of modern times.

A certain degree of popularity has been obtained by the *Spelin* of Prof. George Bauer, of Agram, in Croatia. It is based upon Volapük, and adopts the same grammatic devices, but with greater simplicity;

it is much more euphonious than the creation of Schleyer, and to those who favor a language on any such plan must commend itself by its greater consistency. It requires but six vowels and fifteen consonants to express its repertory of sounds. Of course, its synthetic and inflectional character is, in our opinion, a return to worn-out and barbarous expedients certain not to be acceptable to the civilized man of the future and contrary to linguistic evolution.

It was to be expected that the opinions advanced by your Committee —opinions in many respects both novel and positive—should have been met in various quarters with opposition. This has been the case. The most noteworthy rejoinder is that of the well-known linguist, Mr. Alexander J. Ellis, speaking for the Philological Society of London. In a paper, some forty pages in length, published in the Transactions of that Society, this writer actively combats both the theories advocated by your Committee, and the call for a Congress to consider the question. Not, however, that Mr. Ellis underestimates the desirability of a universal language or considers the project utopian or untimely. On the contrary, he is an earnest advocate of the scheme. He heartily coincides with everything in that direction which any one will urge. What, then, is the animus of his long, labored and acrid opposition to the modest proposal that a Congress of competent men should be convened to consider it? The explanation is in a word. He is a Volapükist, a committed Volapükist, and the Philological Society is hasty enough to allow itself to be officially committed likewise to the imperfect invention of Schleyer, not even opening its mind to the consideration of any other and perhaps better plan. If this is the position assumed by a society calling itself scientific, its appreciation of the spirit of science is indeed unfortunate.

What are Mr. Ellis' censures of the Committee's Report? He makes much of some typographical errors; he meets a number of our censures of Schleyer's Volapük by stating that "other writers" upon that invention do not adopt the features to which we objected; a statement totally irrelevant, as our remarks applied solely to Volapük proper, and not to its dozen variants and imitations; he cannot and does not deny the needless difficulties of the Volapük alphabet; and he takes great offense that we recommended the Aryan languages, especially the half-dozen most cultivated and extended of them, as the proper basis for the hoped-for universal tongue. This latter is really his main objection, and it is an objection which we shall not pretend to answer in this connection. It is enough to reaffirm what seem to us the two sun-clear principles for the formation of a world-language, if one ever is formed: First, that it should be based, phonetically, grammatically and lexicographically, on the languages of the five or six most cultivated nations in the world (all of whom happen to be Aryan); and, secondly, that these languages should be studied for this purpose in their most recent evolutions, in order to imprint on this world-speech

those characteristics toward which Aryan speech has for thousands of years been trending.

It seems to us that any one who denies the latter principle can have no proper conception of the philosophic relation of speech to thought, of logic to grammar, of grammatic matter to grammatic form, and must be blind to the indisputable fact that the changes in language mean the evolution of language from lower to higher stages, from inadequate to adequate expression. It seems incredible that any one acquainted with the distinction between form-languages, like the English, and formless languages, like the Ural-Altaic group, could give the preference to the latter; and yet Volapük distinctly associates itself with the latter.

Its deficiencies have been repeatedly pointed out since the publication of our Report. Our fellow-member, Mr. Horatio Hale, has dealt with it trenchantly in *The Critic* (October, 1888); Prof. Addison Hoge, in *The Nation* (Feb. 9, 1888), has exhaustively analyzed it and shown its weak points; and a number of other periodicals have been forwarded the Society containing similar expressions of opinions.

Certainly if we have not accomplished more, we have aided in displaying the ineffective character of the claims of Volapük to become a world-language; and that we have accomplished this is the true secret of the labored attack of Mr. Ellis and the London Philological Society.

The justice of our strictures has been recognized both at home and abroad. Thus Leopold Einstein, of Nuremberg, in a work on "The International World-Language Problem"—himself for years a zealous advocate and teacher of Volapük—says that of all the critics of that scheme, "especially the American Philosophical Society" has pointed out where its short-comings are, and himself renounces it in favor of the Aryan principles (*La Linguo Internacia*, p. 1, Nürnberg, 1888). Dr. F. S. Krauss, of Vienna, fully acknowledges that the defects we pointed out will prove fatal to Mr. Schleyer's scheme, and adds, "*Bei uns ist für Volapük kein Boden!*"

Herr Julius Lott, another Vienna linguist, for years a zealous apostle of Volapük, has been so completely converted, chiefly by the Report of your Committee, that in his late work on the world-language problem, he expresses himself thus: "I consider that any substantial betterment of Schleyer's language, on the plan of the Volapük, is wholly impossible, because the inventor, in its very construction, pursued a false route, or, plainly, he put the halter on the horse's tail," p. 7. He therefore passes over entirely to the Aryan system which we have so strongly urged, and is now publishing a work in numbers to explain the scheme—and a work, we are glad to add, of signal merit.

Whether Mr. George J. Henderson, whose book, "Lingua, an International Language," which appeared in London last spring, was familiar with our Report or not, he does not say; at any rate, he fully

recognizes the radical defects of Schleyer's plan, and ranges himself positively with those who seek to place the proposed international tongue on an Aryan basis.

Of course the delivery of the London Philological Society, bound hand and foot into the Volapük camp, excited high jubilation among the warriors beneath its banners. The Volapük journal in Vienna, *Rund um die Welt*, begins a four-page leader with the heartfelt shout, "Gottlob, es wird Tag!" "Thank God, the day breaks!" And the editor goes on to say that from the 15th of June, 1888, when Mr. Ellis' Report was read, a new epoch began in the history of Volapük. Other advocates of the system were not less gratified at the Philological Society's questionable procedure.

There were Volapükists, on the other hand, who saw that at least some of the objections urged by your Committee were unanswerable, and sought to avoid them by charging them to the "eccentricities and crudities of Mr. Schleyer," adding the explanation that the Volapük academies had removed most of these objectionable features from the worthy father's invention. This, however, excited the ire of Father Schleyer himself, and he came out in June of this year with an emphatic *ipse dixit* which must have set the Volapük academicians in some confusion. "Any resolution," says Herr Schleyer, "any resolution of the Academy not accepted by the inventor is *null*, even if the whole of the members united against the inventor."

It is quite evident that our Report has let in some light among the Volapükist, as the *Rund um die Welt* says, but not exactly in the manner the editor of that journal supposes. By that light it is plain to see that Volapük even among its warmest adherents is splitting up into dialects and dissimilarities which will soon bring its advocates into the confusion of the builders of the tower of Babel.

A far more important Report than that of Mr. Ellis was one presented to the Société Zoologique de France, by MM. M. Chaper and Dr. P. Fischer, relative to the proposition emanating from the American Philosophical Society. We name it as certainly the reply the most scientific in spirit and intelligent in grasp of any we have received, and we distinguish it as such in spite of the fact that it attacks with earnestness the position your Committee has assumed on many points. Thus it is very severe on our opinion that modern mixed languages or jargons should receive especial attention in forming a proposed world-language; indeed, it denies that there is need of forming any new language at all, and declares in favor of the adoption of some now living tongue as the international scientific and commercial speech. On the other hand, it is equally emphatic in the opinion that such a general language is most desirable, and cordially seconds the proposal of our Society for a Congress to consider the question.

Similar published approvals have come to us in the pages of *La Cronica Rosa*, Messina, Italy; *El Correo*, Madrid, and various other

periodicals. The members of the Committee have even been individually honored by a dedication to them of Dr. P. Steiner's *Uebungen zur Pasilingua*, in recognition, as he expresses it, "of their philanthropic efforts in linguistic science." The well-known English scientific periodical, *Nature*, thought the Report of sufficient value to republish it in full, and an extended analysis and criticism of it were published in German by Prof. George Bauer, while another one was written in French in the *Cosmos*, May 5, 1888.

Of direct adhesions to the proposal for a Congress we may especially mention in our own country the American Association for the Advancement of Science, which, at its meeting in August, 1888, appointed representatives to attend the Congress should it be convened. The University of South Carolina writes through its President: "The effort of the American Philosophical Society commands our hearty approval and sympathy;" and the distinguished linguist, Prof. F. A. Marsh, President of Lafayette College, says: "The object seems a worthy one, and I am glad that the American Philosophical Society has undertaken to promote it."

The Senate of the University of Edinburgh officially "express sincere sympathy with the object;" the Royal Danish Academy of Sciences and Letters "acknowledges fully the scientific importance of the subject;" the Geographical Association of Halle considers the aim "one most desirable both in the interests of science and ordinary intercourse;" the Batavian Society of Rotterdam expresses the hope "that these efforts will be most successful," and similar expressions of cordial approval have been received from the Massachusetts Institute of Technology, the Georgia Historical Society, the Colorado Scientific Society, the Royal Society of Victoria, the Yorkshire Polytechnic Society, and the Asiatic Society of Bengal.

Of individual expressions of opinion by distinguished specialists, we permit ourselves to quote the following from a letter from Prof. James Geikie, of Edinburgh: "I agree with the conclusions come to by your Society, and think that the time has come for the serious consideration of the question of a new language." The Rev. W. S. Lach-Szyrma, himself a prominent linguistic scholar, writes: "I believe, in spite of the decision of the London Philological Society, that the plan you suggest is the sole mode of introducing a universal language." The Hon. Robert C. Winthrop, of Boston, says: "I can see nothing but good to result from the resolution of your Society," and the President of Haverford College states that the Report of the Committee meets his cordial endorsement.

It is gratifying to your Committee and complimentary to the Society to have received such outspoken recognition of their efforts as the above extracts exhibit. They completely set at rest the fears felt in some quarters that the Society had ventured upon a subject of doubtful importance or uncertain judiciousness.

Naturally several of the societies who fully approve the plan of a

Congress are, for financial or other reasons, not in a position to send delegates to a Congress; of the total number of replies received, about twenty have expressed their willingness to do so. As some months may be allowed to elapse before a call for a Congress is issued, your Committee does not recommend any present action, and desires to be continued.

D. G. BRINTON, M.D.,
HENRY PHILLIPS, Jr.,
M. B. SNYDER,
Committee.

On motion of Mr. Dudley, the report was approved and the Committee was continued. The Secretaries were directed to cause to be printed separately a sufficient number of copies of the said report for general use.

Dr. Brinton offered the following resolution:

Resolved, That the books of reference belonging to the Society be not loaned from the Society's hall.

Mr. Dudley offered an amendment, striking out the words "of reference," which was accepted by the mover of the proposition. A debate ensued upon the question, and Mr. Winsor moved that the matter be referred to the Committee on Library, with instructions to consider and report upon the same.

Prof. Snyder raised a point of order that the provisions of the laws could not be changed by a mere resolution of the Society.

The Chair decided that the resolution did not conflict with the laws.

Mr. Winsor's motion was then put to a vote and declared to be lost.

The question then recurring upon the original motion as amended, Dr. Hays desired the opinion of the Chair as to whether it clashed with the laws of the Society; the Chair decided the point in the negative, and, a vote being taken on the motion, it was declared lost.

Mr. Winsor moved that the whole subject of removal of books from the Library be referred to the Committee on Library, with instructions to consider the same and report thereon.

And the Society was adjourned by the President.

Stated Meeting, December 21, 1888.

Present, 24 members.

President, Mr. FRALEY, in the Chair.

Correspondence was submitted as follows:

A letter from M. Tommaso Caunizzaro, Messina, acknowledging receipt of diploma.

A letter from the University of Cambridge, England, in reference to "the important project" of the Convention, proposed by the Society, to frame an international language.

Letters of envoy were received from the Musèe Guimet, Paris, and K. Akademie der Wissenschaften, Berlin.

Letters of acknowledgment were received for Proceedings, No. 127, from Prof. J. S. Newberry, New York; Academy of Sciences (also, Transactions XVI, ii), New York City, and Prof. J. P. Lesley, Philadelphia.

Accessions to the Library were received from the K. Akademie der Wissenschaften, Wien; Dr. Adolph Bastian, Berlin; Verein für Lübeckische Geschichte und Alterthumskunde, Lübeck; Société de Physique et d'Histoire Naturelle, Genève; Société Hollandaise des Sciences, Harlem; Société d'Émulation, Abbeville; Société d'Histoire et d'Archiologie, Chalon-sur-Saone; Alliance Scientifique Universelle, Sociétés d'Anthropologie, and de Géographie, Marquis de Nadaillac, Paris; Société Historique, Littéraire, Artistique et Scientifique du Cher, Bourges; R. Academia de la Historia, Madrid; Dr. B. W. Richardson, London; Philosophical Society of Glasgow; Peabody Museum, Cambridge, Mass.; Yale University, New Haven; Messrs. Philip C. Garrett, Thomas Hockley, Henry Phillips, Jr., Philadelphia; Pennsylvania Geological Survey, Harrisburg; Johns Hopkins University, Baltimore; United States National Museum, Bureau of Education, Washington; Georgia Historical Society, Savannah; Academy of Sciences, St. Louis; Dr. Antonio Peñafiel, México.

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A biographical sketch of the late Thomas U. Walter, by Mr. Joseph M. Wilson, was read.

The death of Dr. Caspar Wister (December 20, 1888, æt. 71) was announced, and, on motion, the President was authorized to appoint a suitable person to prepare the usual obituary notice.

This being the evening for balloting for candidates for membership, the pending nominations Nos. 1181 and 1182 were read and spoken to and voted upon.

The following communication from Mr. Aubrey H. Smith was read:

"In Boott's illustrations of the genus Carex, we have *Carex miliaris Michaux*, figured from the original specimens of *Michaux*, preserved in the Herbarium Richard, at the Jardin des Plantes, Paris. Boott says: 'This species is the only one of those described by Michaux which has not been satisfactorily ascertained by recent observers.' Mr. Charles E. Smith and I collected a Carex on the gravel bars of the Kennebec river, at the outlet of Moosehead lake, in the years 1865 and 1867, which was thought by Gray to be *C. miliaris* (see Manual, ed. 5, 1867). C. E. Smith afterwards found it in other places on Moosehead lake. I collected it about 1872 on the gravel bars of Marguerite river and Lake St. John, Lower Canada. My specimens agree with the engraved figure in Boott, and were submitted to T. C. Porter and Olney, and by them recognized as *Carex miliaris*."

Dr. D. G. Brinton read a paper on the *Tai-Ki* and the Swastika in America.

A paper by Dr. W. J. Hoffmann (Washington, D. C.), entitled "Grammatic Notes and Vocabulary of the Pennsylvania German Dialect," was presented through the Secretaries.

On motion, the Secretaries were authorized to print the same in the Proceedings of the Society if so desired by them.

Prof. Lesley presented a paper entitled "Description of New Species of Fossils from the Clinton, Lower Helderberg, Chemung and Waverly groups," by George B. Simpson.

On motion, the paper of G. B. Simpson was referred to a special committee of three, to be appointed by the President at his leisure, to examine for the Transactions. (Subsequently the President appointed Messrs. Lesley, Horn and Heilprin as such committee.)

The Committee on Finance reported that it had examined the Annual Report of the Treasurer, submitted at the last meeting, and that it was correct, and would report on the appropriations at the next meeting.

The Committee on the Library recommended that the works of reference in the Society's Hall be not permitted to be removed; that, in its opinion, the other books should be loaned as heretofore.

On motion, the recommendations were adopted.

The Committee on the Codex-Poinsett reported progress, and, on motion, was continued.

On motion of Mr. Vaux, the Society reconsidered Section 12 of the Report of the Committee on the Henry M. Phillips' Prize Essay Fund so that it should read as follows:

Twelfth. A Standing Committee, to consist of five members and the President and the Treasurer of the Society, shall be appointed by the President, which shall continue in office during the pleasure of the Society, and any vacancies that may occur in said Committee shall be filled by new appointment by the President.

The motion was put to a vote and adopted unanimously.

The Tellers reported, after a scrutiny of the ballots, that the following candidates had been duly elected members of the Society, viz.:

No. 2154. Arthur Biddle, Philadelphia.

No. 2155. Il Marchese Antonio dè Gregorio, Palermo.

And the Society was adjourned by the President.

Biographical Notice of Thomas Ustick Walter, A.M., Ph.D, LL.D., Late Member of the American Philosophical Society.

By Joseph M. Wilson, A.M., C.E.

(*Read before the American Philosophical Society, December 21, 1888.*)

In the year 1749, an orphan boy, owning nothing but the clothes on his back, friendless and alone, was put up at auction in this city of Philadelphia, and sold as a German redemptioner.

This boy was Frederick Jacob Walter, the grandfather of Thomas Ustick Walter, the subject of this memoir.

Emigrating from Germany with his parents, both of whom died at sea with the plague, leaving no information whatever behind them, the poor lad literally commenced life anew. Passing his youth as a servant in the old Carpenter mansion, on Chestnut street, above Sixth, where afterwards stood the Philadelphia Arcade (now replaced by other buildings), when he became free, he took up the trade of bricklaying, and, at a later date, as master bricklayer, was associated in partnership with Frederick Graff, grandfather of a prominent and well-known civil engineer of this city—the present Frederick Graff.

He was twice married, Joseph Saunders Walter, one of his sons by his second wife, born May 15, 1782, on Fifth street, below Arch, being the father of Thomas Ustick Walter.

This son early showed a disposition in favor of the arts of construction, and not inclining toward the business of a tobacconist, to which he had been apprenticed, he followed his father in the trade of bricklaying, as soon as he was at liberty to do so, adding to it that of stone masonry, and earning for himself a solid reputation in this city, where he carried on building operations with success for more than forty years, and where he was connected with much prominent work. He was associated, under a special partnership, with Daniel Groves, in the construction of the United States Bank, now the Custom House. The Philadelphia Exchange was also built by him.

He was a popular and esteemed citizen, an attractive and fluent speaker, and occupied several offices of public trust with honor. He was an ardent and devoted Christian, a member of the Baptist Church, on Second street, below Arch, and a deacon for many years.

Thomas Ustick Walter, the eldest of seven children, was born in Philadelphia, September 4, 1804, and was named after the Rev. Thomas Ustick, the former pastor of his parents. He received a liberal, although not a collegiate, education, and, as a boy, developed a great fondness for mathematics; at the same time showing a marked talent for drawing, with an inclination toward the profession of architecture and building construction.

At the age of fifteen, his scholastic studies were suspended, and he en-

tered the office of William Strickland, a prominent architect of the day, as a student. Under Mr. Strickland's eye, he became proficient in linear drawing, and, at the same time, acquired some insight into the professional practice of architecture. He did not remain with Mr. Strickland more than two years; and undoubtedly soon discovered his deficiencies in theoretical knowledge, as it is found that he resumed his general studies, and took a thorough, special course in mathematics. For seven years he devoted himself to the study of the physical sciences, and to the arts of drawing and painting, taking lessons in landscape painting, in water-colors, with Mason, a celebrated teacher of that time. He also endeavored to obtain a thorough knowledge of the details of mechanical construction.

In those days, technical schools did not exist. There were no prepared courses of study, and few or no books relating to the subjects in question. The student of to-day can hardly appreciate all of the difficulties under which young Walter labored; and the foresight and determination which he displayed in his preparation for the profession to which he had determined to devote himself were certainly very remarkable. The results showed in after-years. And his exceptional progress, when once fairly started in his business, must have been largely due to this previous training.

In 1828, he again became a pupil of Mr. Strickland, and, under the latter's instructions, he remained for two more years, devoting himself exclusively to the study of architecture.

How few would have done this! One would have thought that, after these seven years of study, the temptation to commence business for himself, now at the age of twenty-four, would have been irresistible. But it was not until the year 1830 that he commenced the practice of his profession.

The following year he designed the Philadelphia County Prison, his first important work (his appointment as architect taking place on October 14, 1831), and the entire structure was erected in accordance with his plans, and under his personal superintendence.

In 1833, the Select and Common Councils of Philadelphia adopted his design for Girard College, the corner-stone of the main building being laid on the fourth of July of the same year, and the structure carried on to its completion in 1847, altogether from his designs, and under his charge.

The Building Committee of the college sent him to Europe in 1838, in order that he might examine into the practical workings of the various institutions of learning in Great Britain and on the Continent, as to questions of health, convenience, and comfort; so that the experience of these institutions, and a study of the various devices and appointments there adopted for furthering these ends, might prove useful in fitting up and furnishing the buildings of the college. His instructions also included the investigation of building improvements in general.

He left New York July 7, reaching Liverpool on the 28th of the same month, and returned November 22, after a boisterous passage of thirty-two days, making a trip of about four and a half months.

When it is remembered that fifty years ago very few railroads existed, and that a considerable quantity of Mr. Walter's time was consumed in crossing the ocean by packet ships, it will be seen that he accomplished a large amount of work in a very short period, and that he displayed great energy in his mission. For it is found that he examined the leading institutions of England ; then went to Paris, and thence to Italy, stopping at Dijon and Geneva, crossing the Alps by the Simplon, and spending some time in Milan and Florence. After this he went to Rome, and then crossed over, by post, to Civita Vecchia, where he embarked on a Mediterranean steamer for Marseilles, taking Leghorn and Genoa on his way. From Marseilles, he went, by post, back to Paris, and, after further researches there, returned to London. His journey continued to Liverpool and Dublin ; thence, by way of the north of Ireland, to Scotland, and back, through Newcastle-on-Tyne, York and Manchester, to Liverpool, whence he sailed for home. One could hardly have done better, even in these days of rapid railroad traveling.

The valuable information which he gained was submitted in an elaborate report, containing a full account of the improvements and devices which had been adopted, in the various institutions he had visited, for promoting cleanliness, comfort, and convenience ; and the Girard College buildings were afterward finished and fitted up in accordance with his suggestions.

Mr. Walter was requested by the Government of Venezuela, in 1843, to visit La Guayra, and to make an examination of the port, for the purpose of considering the feasibility of building a mole, or breakwater, that would shelter the quay from the violence of the sea, and would allow more facility in the discharging of cargoes.

He sailed in July of that year, arrived at La Guayra, after a voyage of twenty days, and immediately proceeded to Caracas, for the purpose of consulting the authorities ; after which he returned to La Guayra, made a survey of the harbor, took soundings, studied the tides, currents, and winds, and gathered historic data in connection with the question. He then prepared his designs, specifications, and estimates, all of which were approved by the Government ; and on October 12, 1843, he entered into a contract for the execution of the work.

He returned home at once, and, after making all the necessary preparations, departed again for La Guayra, on October 12, 1844, with some competent workmen, and a cargo of materials, machinery, and other apparatus—all of which arrived safely at their destination. The work was commenced immediately, pushed with vigor, and rapidly brought to completion.

Mr. Walter's eldest son accompanied him, as assistant engineer, but died of the fever of the country soon after his arrival.

There were many difficulties to encounter, but they were met with his usual energy ; and the work was finished, and officially accepted by the Government, October 24, 1845.

On June 11, 1851, Mr. Walter was appointed architect of the extension to the United States Capitol, at Washington, by Millard Fillmore, President. His plans for the work were adopted, and he was directed to proceed with their execution. The new dome to the building, which was not at first intended, was afterwards included in his commission.

This work was really the crowning achievement of Mr. Walter's life, and he was well worthy of the appointment. No man in the profession, at that day, was more deserving of it; and his studies and training peculiarly fitted him for the type of architecture which the problem demanded.

Standing in view of that building to-day, enlightened with all the advancement in architecture that has taken place in this country, with such immense strides, during the past fifteen years, the most exacting critic must acknowledge that it is a noble and commanding pile, with its incomparable dome crowning the mass, and adding dignity and repose to the whole.

Mr. Walter held this appointment for fourteen years, and, during the same time, planned and executed, for the Government, the extension of the General Post Office, and the east and west wings of the Patent Office. He also designed the new Treasury building, the Marine barracks at Brooklyn, N. Y., and at Pensacola, Florida, and the Government Hospital for the Insane, at Washington.

In 1852, after the old Congressional Library was destroyed by fire, Mr. Walter was engaged to prepare designs for its reconstruction, which he afterwards executed. The work comprised many new features in architectural practice, and was, in its construction, fire-proof throughout.

On the completion of his work on the Capitol building, in 1865, Mr. Walter resigned from his position and returned to Philadelphia, retiring from the active practice of his profession, and intending to devote his time, for the balance of his life, to scientific and literary pursuits, and to the advancement of art. In addition to the works already mentioned, he had designed and executed numerous public buildings in his native city and throughout the country; besides which, he had had an extensive private practice.

But Providence does not always dispose of things as man proposes. Unfortunate investments reduced the savings of years so seriously that, in 1873, Mr. Walter was compelled to dispose of his comfortable Germantown home, to take a smaller and cheaper house in the city, and, at the age of nearly seventy years, to recommence the practice of his profession.

To illustrate the character of the man, it may be said here, that he entered the service of the writer (who was then an officer of the Pennsylvania Railroad Company), as an assistant by courtesy, although really with the duties of a draftsman, occupying a position far below his capacity, it being the only available opportunity for immediate regular employment; and with Christian cheerfulness and resignation he attended to the daily work devolving upon him for more than a year, until the architect of the City Hall was enabled to offer him a position more in accordance with his professional standing.

It was in this close personal relation with Mr. Walter that the writer learned to know, to love and to respect him; to cement a friendship and to acquire an admiration for him which never were broken

Mr. Walter continued his connection with the architectural department of the City Hall until his death, which took place at 7 A.M., on Sunday, October 30, 1887, at the ripe age of over eighty-three years.

"The days of our age are three-score years and ten; and though men be so strong that they come to four-score years, yet is their strength then but labor and sorrow; so soon passeth it away, and we are gone."

Providence was kind to him; and while his later years were full of labor and sorrow in one sense, yet the sorrow was tempered with his own habitual cheerfulness, the love of his family and friends, a house to cover his head, and provision for daily wants, if no more.

Mr. Walter possessed naturally a vigorous and healthy constitution; and although rejected at one time by a life insurance company on account of a supposed heart trouble, yet he told the writer once that he had never had an illness in his life that required the attendance of a physician. While in his later years, his powers gradually failed, still he held out, even to the end, and was up and about the house the day before he died.

Mr. Walter was twice married; and he had thirteen children, seven of whom still survive him. His descendants include thirty-four grandchildren and eleven great-grandchildren.

Mr. Walter received the honorary degree of Master of Arts from the Madison University of New York, in 1849; that of Doctor of Philosophy from the University of Lewisburg, Pa., in 1853, and Doctor of Laws from Harvard University in 1857. In the year 1860, he delivered a course of lectures on "Architecture" before the students of Columbia College, D. C.; and he also delivered from time to time many popular lectures on the same subject in Philadelphia and its vicinity.

In 1836, he endeavored, with some others, to form an American Institution of Architects; but the efforts to make a permanent organization failed, on account of the members of the profession in this country, at that time, being few in number, and widely scattered. When a second effort was made in 1857, and the present American Institute of Architects was founded, Mr. Walter took an active part in the work, and continued it through his life. He was made a Fellow in that year, and, on the retirement of its first President, in 1876, he was elected President—an office he filled continuously from year to year until his death. Mr. Walter was elected a member of the Franklin Institute in 1829, and one of its Board of Managers in 1830. He took great interest in matters connected with that Institute, was a frequent contributor to the pages of its Journal, and was elected Professor of Architecture in 1840. The Report of the Boar of Managers for that year states that "Mr. Walter has just closed his series of lectures for the present season; and the Board feel that, in bringing a mind like his, clothed with all the knowledge and experience which places the resources of that art, both ancient and modern, tributary to the

illustration of his subject, they have not only contributed to the advancement of the class in a proper appreciation of the beautiful in building, but likewise connected that knowledge with the expressive and high-wrought poetry with which the grand but crumbling monuments of skill have been commemorated."

Mr. Walter held the position of Chairman of the Board of Managers of the Franklin Institute during the year 1846.

Mr. Walter was elected a member of the American Philosophical Society on October 18, 1839, and at the time of his death had been a member for forty eight years. His deep interest in scientific research and in all matters connected with the promoting of useful knowledge, led him to take an active part in the Society ; and his face was a familiar one at its meetings, so long as his age and physical condition allowed him to attend them.

He was a true Christian gentleman of the old school ; a Baptist by profession, active in his church, courteous and dignified in his manners, and one whose presence will be missed by his friends until they, too, follow him.

He fulfilled his mission in this world well ; and, at an age beyond that usually allotted to man, he departed to his reward.

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EXTRACT FROM THE BY-LAWS.

CHAPTER XII.

OF THE MAGELLANIC FUND.

SECTION 1. John Hyacinth de Magellan, in London, having in the year 1786 offered to the Society, as a donation, the sum of two hundred guineas, to be by them vested in a secure and permanent fund, to the end that the interest arising therefrom should be annually disposed of in premiums, to be adjudged by them to the author of the best discovery, or most useful invention, relating to Navigation, Astronomy, or Natural Philosophy (mere natural history only excepted); and the Society having accepted of the above donation, they hereby publish the conditions, prescribed by the donor and agreed to by the Society, upon which the said annual premiums will be awarded.

CONDITIONS OF THE MAGELLANIC PREMIUM.

1. The candidate shall send his discovery, invention or improvement, addressed to the President, or one of the Vice-Presidents of the Society, free of postage or other charges; and shall distinguish his performance by some motto, device, or other signature, at his pleasure. Together with his discovery, invention, or improvement, he shall also send a sealed letter containing the same motto, device, or signature, and subscribed with the real name and place of residence of the author.

2. Persons of any nation, sect or denomination whatever, shall be admitted as candidates for this premium.

3. No discovery, invention or improvement shall be entitled to this premium, which hath been already published, or for which the author hath been publicly rewarded elsewhere.

4. The candidate shall communicate his discovery, invention or improvement, either in the English, French, German, or Latin language.

5. All such communications shall be publicly read or exhibited to the Society at some stated meeting, not less than one month previous to the day of adjudication, and shall at all times be open to the inspection of such members as shall desire it. But no member shall carry home with

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Mar. 30. 1889.

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